

Landscape Guidelines For Durham, North Carolina

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Durham City County Planning Department

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1. Introduction

The guidelines included in this Appendix apply to all new development, governed by the permitting process defined in the Durham Unified Development Ordinance (UDO). Any property developed or substantially changed under a permit approved by the Durham City-County Planning Department or Durham City-County Inspections Services Department is subject to the planting guidelines of this Appendix. Periodic updates to this Appendix may be made by the Planning Department after review by the Joint City County Planning Committee.

The Landscape Guidelines are a compilation of the latest accepted horticultural practices. They are meant to be used by North Carolina Landscape Contractors and Planning Department Landscape/Site Inspection staff to help assure that installed landscapes thrive once planted. They contain definitions, text descriptions, and plant lists. Sections within these Guidelines provide more detailed information on tree protection than are found in the UDO, including planting guidelines and suggested species.

These Guidelines will be used by staff to assess landscape installation. The information is designed to be used as a supplement to Articles 8 and 9. All those who install landscape material subject to the Planning Department approval towards a Certificate of Compliance are expected to follow these guidelines. Failure to follow these guidelines may result in the issuance of a stop work order or failure to be approved for Certificate of Compliance.

2. Definitions

Allelopathic.....	The suppression of growth of one plant species by another due to the release of toxic substances.
Annuals	Flowering plants, used to provide seasonal color and interest. Root stock dies in winter, therefore annuals need replanting each growing season. Annuals are often referred to as bedding plants.
B&B	Balled and burlapped. Refers to plants dug in the nursery and wrapped in burlap with firm, natural balls of earth, of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant from the shock of being dug up and replanted.
Caliper.....	Standard trunk diameter measurement for nursery grown stock taken six (6) inches above the ground up to and including four (4) inch caliper size, and twelve (12) inches above the ground for larger calipers.
Canopy	The branched portion of a tree or forest.
Canopy tree (CT)	Large deciduous shade trees with a mature height of 30 feet or greater and a mature spread of 30 feet or greater in the Suburban or Rural Tiers or, in the Urban, Compact and Downtown Tiers, a mature height of 20 feet or greater. For the purposes of Table 1 ,

	Recommended Trees , canopy trees will include those 30 feet or greater in mature height. See Section 9.2.2 and 9.2.3 for definition and specifications.
Central Leader.....	Primary or terminal shoot, i.e. the trunk of a tree.
Cut.....	The exposed wood area that remains after a branch has been removed.
dbh	Diameter-at-breast-height is a standard measurement of existing tree size, and is the diameter of a tree trunk measured in inches at four and a half (4.5) feet above the ground. See Section 16.3 of the UDO.
Deciduous	Those plants that annually lose their leaves.
Deciduous understory (DU).....	Small deciduous trees or large deciduous shrubs with a mature height of 10 to 30 feet, except under overhead utilities, where lower heights at maturity may be required. See Sections 9.2.2 and 9.2.3 for definition and specifications.
Dormant	A condition of non-active plant growth. Deciduous trees and shrubs are considered to be dormant from the time their leaves fall until new foliage begins to reappear.
Ecosystem	The complex of a community of organisms and its environment.
Evergreen	Those plants that retain green or live foliage throughout the year.
Evergreen tree (ET).....	Trees at least 20 feet tall at maturity that usually have green foliage throughout all seasons of the year. See Sections 9.2.2 and 9.2.3 for definition and specifications.
Evergreen understory (EU).....	Trees or large shrubs at least 10 feet tall at maturity that usually have green foliage throughout all seasons of the year. See Section 9.2.2 and 9.2.3 for definition and specifications.
Exotic	Plants that are not native to Durham or the Piedmont region of North Carolina.
Groundcovers.....	Usually evergreen, spreading growth form, used to control erosion and pedestrian traffic.
Herbaceous.....	Plants that die back to the ground each winter, sometimes leaving dead leaves or dried flowers for winter interest.
Height.....	Taken from the ground level to the average height of the top branches of the plant, and not to the longest or tallest branch.
Improper pruning	For deciduous trees: the removal of the central leader or the shortening of branch ends. For deciduous shrubs: removal of more than a third of healthy growth. For evergreen trees and shrubs: removal of more than a third of growth. For all trees and shrubs: use of tools leaving uneven or broken cuts or wounds.
Invasive plant.....	A non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Nearly all invasive species that are thriving and reproducing on their own were originally imported for landscape use and have escaped cultivation through dispersal by wind or by birds that eat their fleshy fruits or seeds (and may prefer them over native plants). These characteristics mean that seeds will be deposited some distance from the source. Often exotic plants are not satisfactory for wildlife habitat, although they may displace native species necessary for such habitat. Unless otherwise indicated, cultivars of invasive plants are also considered to be invasive.

Landscape plan	A plan showing types, numbers, sizes, and locations of plants to be planted or preserved.
Lifting or limbing up.....	The removal of lower branches for under clearance.
Native.....	With respect to a particular ecosystem, a species that other than as a result of an introduction historically occurred or currently occurs in that ecosystem. For the purposes of this Appendix, native trees in Table 1, Recommended Trees are those that are native to Durham County and native shrubs in Table 2, Recommended Shrubs are native to the Piedmont region of North Carolina. Cultivars and clones of native species are also considered to be native for the purpose of this Appendix.
Ornamental grasses	Herbaceous plants which may be perennial or annual, but generally are not evergreen and not allowed for credit.
Perennials.....	Flowering plants whose root stock survives the winter. Used to provide color/textural interest, and control pedestrian traffic, seldom used for screening.
Pruning.....	The removal of dead or diseased, live but interfering, and/or weak branches.
Riparian.....	Related to or living or located along the bank of a watercourse, such as a stream or river.
Root Protection Zone (RPZ)	The land area around the base of a tree in which disturbances are prohibited in order to protect the roots of a tree and aid in the tree's survival. The RPZ is the greater of a six (6) foot radius around the tree or one foot of radius for every inch in dbh of the tree. See Sections 8.3.2 and 16.3 of the UDO.
Sample area	A representative inventory of all trees, shrubs and groundcover within a minimum 20 foot by 20 foot area for each unique stand of vegetation to be retained and identified on the landscape plan. Sample areas are required for all existing buffers and other tree preservation areas in order to obtain credit for existing plants. See Section 9.3.3 for definition and requirements, and Figure 5, Sample Area Example for a graphic representation of the required information.
Scars or Injuries	Natural or man-made lesions of the bark in which wood is exposed.
Semi-evergreen	Plants that retain green or live foliage through mild winters but may lose their foliage during colder ones.
Shrubs (DS or ES).....	Prostrate or upright woody plants, either evergreen (ES) or deciduous (DS), with a mature height usually less than 10 feet. Evergreen shrubs usually have green foliage throughout all seasons of the year. Shrubs usually have branches to the ground and may be used as accent, focus, or if evergreen, as screening material. See Sections 9.2.2 and 9.2.3 for definition and specifications.
Species	A group of organisms, all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.
Specimen tree.....	Any healthy tree with a diameter of eighteen (18) inches or more dbh, other than trees of the <i>Pinus</i> genus, except in the Rural Tier where trees of the <i>Pinus</i> species are considered specimen trees.

	See Section 8.3.3 of the UDO for specimen tree survey requirements and 16.3 for definition.
Vehicular use area (VUA)	Areas used for vehicle service, parking (including structured parking), parking lot drive aisles, and business transactions such as areas adjacent to gasoline pumps (even if under canopy) and areas for drive-up service. VUA does not include driveways that are perpendicular or nearly perpendicular to the street and serve as an entrance to the site. See Section 9.8.1 of the UDO for this definition and applicability.
Water sprouts	Vertical sprouts which grow up through the middle of the tree or shrub, usually from the base.

3. Procedures and General Requirements

Landscape plans shall be prepared by a person who demonstrates knowledge and experience in the field of landscaping and/or site design such as a landscape architect, urban designer, landscape contractor, or horticulturist. The landscape plan shall adequately detail the requirements of this Ordinance. Plans shall include the following:

- (1) A plant list showing: quantity / scientific names / common names / sizes and a key that identifies the location of all plant material on the landscape plan. It may also contain notes that further define characteristics of the plant that the designer wants in the plant selection (e.g. "matching specimens").
- (2) Shrub sizes shall be shown by height only and tree sizes by caliper and height. Container sizes are not required and, if given, must include a note on the plant list as follows: "All plant materials must meet or exceed all sizes shown at the time of installation."
- (3) Proposed drives, paving areas, decks, walks, pools, and other man-made structures/elements which are to be constructed within the property.
- (4) All construction notes/details relating to construction, specific material and planting procedures.
- (5) A table which indicates intended use of existing plant material.
- (6) Consideration of the driveway/intersection sight distance triangle requirements in Section 12.3.1.D and to facilitate safe sight distances within parking lots per Section 9.8.1.C.2. Plants located within driveway medians, at the ends of parking lot islands and within sight distances shall be a species with a mature height of no more than 30 inches.
- (7) Location of all proposed utilities, including lighting, to verify that there are no conflicts either under ground or above the ground. These should be half-toned to make it easier to see the proposed plantings. Trees should not be located where they will grow up into overhead lights or power lines and create dark spots or conflicts. Plants should also not block access to fire hydrants or other above-ground utilities.
- (8) Location of proposed irrigation lines and sprinkler heads (if applicable).

4. Tree Preservation and Care During Construction

A. Tree Preservation (See Section 8.3.2 of the UDO)

- (1) Install tree protection fencing around the “Tree Save Area”. Fencing shall be in accordance with Section 8.3.2. See **Figure 4, Tree Protection Fence Detail** for an acceptable detail for the tree protection fencing.
- (2) The size of the “Tree Save Area” is the area within the RPZ of the tree or group of trees to be preserved.
- (3) When installing tree protection fencing for trees along a wood’s edge, locate the fence at the edge of the Root Protection Zone of the outermost protected trees, and on the wooded side of any silt fencing to be installed in the same location. Using silt fencing, or combining tree protection and silt fencing into one fence, is typically unacceptable for tree protection, but may be accepted in limited circumstances.
- (4) Install tree protection fencing, including warning signs as required in Section 8.3.2.E, before starting any grading or land disturbing activity,. See **Figure 4, Tree Protection Fence Detail**. Alternative fencing materials may be approved by the Planning Director, or designee, in unique circumstances.
- (5) Call the Durham County Sedimentation and Erosion Control and Engineering Department (919-560-0735) to request that the Sedimentation and Erosion Control Officer visit the site to approve the placement of the fencing before doing any other site work.
- (6) Do not disturb the RPZ of any tree(s) in an area designated “Tree Save Area.” In other words do not clear, grub, trench, remove soil, backfill, drive or park vehicles, equipment or materials, dump trash, oil, paint or any material harmful to the health and growth of the tree within the area marked by the tree protection fence.
- (7) Some trees being saved may require root pruning. See **Subsection B. Root Pruning Prior to Construction**, below, for specific guidelines on root pruning.
- (8) Those trees requiring more than a third of their roots pruned/removed are unlikely to survive. A revised land disturbance tree survey (Section 8.3.3.D) and revised site plan may be required in order to remove those trees. Contact the Planning Department Landscape/Site Inspection staff for permission prior to removing these trees.

B. Root Pruning Prior to Construction

- (1) Root pruning may be done on single existing trees located near proposed construction, or at the edge of wooded areas to be preserved prior to the start of clearing or grading, using the following guidelines:
 - (a) Cut roots no more than 6” back from new construction; cut to a depth of two (2) feet maximum with a sharp, vertical cut.
 - (b) Backfill with clean, dry soil within hours of root pruning. Moisten soil the same day.
 - (c) Keep all tools sharp to ensure roots are not broken or torn.
- (2) Do not use climbing irons, spurs or spikes on trees when pruning them.

5. Requirements for Successful Groundcover, Shrub, and Tree Installations

A. Selection of Plant Material

Plant material should be selected in accordance with the attached tables. Plants especially well suited to Durham's soils and climate are shown on **Table 1, Recommended Trees** and **Table 2, Recommended Shrubs**. These tables include Use Categories, which indicate a series of potential recommended uses for landscaping materials. They are as follows:

Use Category	Typical Use Parameters
Suburban Street Trees	Need large area (35 feet minimum) between street and building; especially for use in the Suburban and Rural Tiers (as required)
Urban/Downtown/Compact Street Trees	Adaptable to a smaller area between street and building and tolerate pollution; especially for use in the Urban, Downtown and Compact Neighborhood Tiers
Street Trees Under Power Lines	From the list approved by Duke Power
Parking Lot Trees	Tolerate pollution, poor soils and tight spaces
Parking Lot Shrubs	Shrubs, usually less than 30 inches in height at maturity, or easily maintained at that height, when planted where safe sight distances within parking lots are required, that tolerate pollution, poor soils, hot sun and tight spaces
Buffers/Natural Areas	Wider, Suburban and Rural Tier buffers and natural areas; tolerate some shade
Tree Coverage	Replacement trees that tolerate some shade, usually tighter spaces (except where larger spaces are available)
Urban Screens/Buffers	Tolerate pollution, suitable for narrower buffers or vegetated screens in the Urban, Downtown and Compact Neighborhood Tiers; understory trees and shrubs should tolerate full sun since there may be no canopy trees overhead
Urban Public/Open Spaces	Tolerate pollution but need more space; may be good accent trees or understory
Accent/Other	Shrubs and woody groundcovers that are best used as accents or as described in the notes in the table
Riparian Buffers	Recommended by North Carolina Ecosystem Enhancement Program for stream buffer restoration plantings

Trees and other plants that are not recommended for use due to tendency toward invasiveness, (but not so invasive as to be on the prohibited list), disease, lack of hardiness or other factors are listed in **Table 3, Trees Not Recommended** and **Table 4, Plants Not Recommended**. No landscaping credit is allowed for use of these plant materials. **Table 5, Plants Prohibited for Any Use** lists exotic plant species that are recognized by the North Carolina Botanical Garden or by the United States Department of Agriculture Forest Service, Southern Research Station, for their invasive tendencies and shall not be planted as landscaping for any purpose. Plants not found on any of these

lists may be approved by the Planning Director or designee, and included in periodic updates to the Appendix. For example, most vines, herbaceous plants (including ornamental grasses) and perennials are not listed because they are not usually allowed to meet the landscaping and buffering requirements of Article 9. Non-woody groundcovers have also not been included in the list.

See **Subsection K, Native Grasses** for recommended native grasses for use where stream buffers will be disturbed and re-vegetated, and in any areas that drain directly to streams or wetlands. Recommended winter cover crops, to be used until the season is right for planting the native grasses, are also listed.

Drought tolerance is also indicated in **Table 1, Recommended Trees** and **Table 2, Recommended Shrubs**. Please keep the following in mind when selecting plants for drought tolerance:

“Most plants prefer a moist, well-drained soil. However, provided a plant is otherwise healthy, has had time to become established (normally one to two years after planting), and is provided appropriate cultural conditions (adequate soil drainage and aeration, mulch, moderate to low fertilization, proper pH, appropriate light level, etc.) those plants indicated as drought tolerant should be able to survive a moderate period of limited moisture (rainfall, irrigation). Drought tolerance does not mean the plants prefer hot, dry weather or that they will not be adversely affected by extended dry weather.... High temperatures and wind, heat and light reflection from nearby hard surfaces, and high fertilization can increase the potentially damaging affects of low moisture on plant growth and survival. Fall planted trees and shrubs have demonstrated an increased ability to survive moderate moisture levels compared to those transplanted in the spring or summer.” (NCSU, “Drought Tolerant Shrubs”, December, 2003).

B. Plant Material

- (1) Provide nursery grown plants typical of their species or variety, with normal, densely developed branches and vigorous, fibrous root systems. Provide only solid, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, fire ants, and all forms of infestation. All plants should have a fully developed form without voids and open spaces. All plants should be nursery grown and not field collected unless specifically identified on the approved landscape plan.
- (2) Protect all plants at all times. Protect plants from sun and/or drying winds. Plants that cannot be planted immediately upon delivery to the site should be kept in the shade or covered with burlap to prevent sun scorch. These plants need to be well watered. Plants which remain unplanted for longer than one day should be heeled in (i.e. covered with wet compost, soil, or other acceptable material) and their root ball kept moist by watering. Plants should not remain unplanted on site longer than three (3) days, unless a temporary irrigation system is used.
- (3) Supply all plants as specified in the plant list on the approved landscape plan. Determine from the plan the quantities of each species required. **If a discrepancy exists between the number of plants specified in the Plant List and the graphic representation on the plan, the installer should use the number graphically represented on the plan.** Plants must be typical of their species and variety, have normal growth habit, have well-developed branching,

be densely foliated, and have healthy roots. Size of plants, spread of roots, and size of root ball must be in accordance with the American Standard for Nursery Stock (most current edition). Plants of each particular variety should be uniform in size, density, and configuration.

- (4) Container plants should be grown in the container for sufficient length of time to have a root system dense enough to hold the soil intact, firm and whole, when removed from the container. The root system, however, should not be root-bound, or so dense in mass that it is excessively intertwined or has a circular growth pattern. Single-stemmed (unless specified on approved plan) or thin plants will not be accepted. Side branches should be generous, well-twigged and the plant as a whole well bushed to the ground. For container-grown trees, use fingers or small hand tools to pull the roots out of the outer layer of potting soil; then cut or pull apart any roots circling the perimeter of the container.
- (5) Balled and burlap (B & B) plants should be nursery grown and dug within three (3) days of transplanting. Cracked, mushroomed or 'manufactured' (including the addition of soil inside burlap to meet specifications) root balls are not acceptable. There should be no more than one (1) inch of fill over the original roots. The burlap used to secure the ball should be untreated and biodegradable. B & B plants should have firm balls of earth in which the plant has been growing and of a diameter not less than specified in the American Standard for Nursery Stock.
- (6) All new trees should have straight trunks with an intact single central leader, unless a multi-stem tree is specified. Trees will not be accepted which have had their branches shortened, leaders cut, or have damaged leaders which require cutting. Unless otherwise specified, canopy trees should not have branches within six (6) feet of the top of the root ball. The north side of the trunk should be marked for installation with the same orientation to avoid sun scald.

C. Site and Soil Preparation

Provide tree protection fencing (see **Figure 4, Tree Protection Fence Detail**) to protect any existing trees, shrubbery, and planting beds in the planting area. To protect existing turf in the planting area that may be damaged from being driven over, and upon which soil may be temporarily piled, cover with a tarp or sheets of plywood. Turf protection should be removed immediately as work is completed or at the end of every work day, whichever is shorter.

Create plant beds the size and location shown on the approved site plan. Where several plants will be spaced close together, they should be planted in one larger bed in order to allow for sharing of root space and amendment of all the soil in that bed. All groundcovers and container shrubs should be planted in a shrub bed (see **Figure 3, Shrub Planting Detail**). B & B material, or large container material, may be planted in individual planting holes. The planting area should be wide enough to accommodate all roots without crowding, and contain nutrient rich soil.

In order to ready the planting areas, prepare the soil by taking the following steps:

- (1) Remove all vegetation and topsoil from the top three (3) inches of the planting area for both planting beds and plant holes. Remove unwanted vegetation from the site, stockpile topsoil on site for future use or remove from site if specifically stated in the approved Site Plan.

- (2) Dig all shrub beds two (2) to three (3) times the width of the root mass and all tree planting holes a minimum three (3) times the width of the root ball in highly compacted or clay soils, or two (2) times the width of the root ball in all other soils, with a minimum of nine (9) inches on each side of the root mass or ball for shrubs and 12 inches for trees. Tree planting holes should be wider at the top with tapered sides. This can be accomplished by digging with a large auger to the required depth and then breaking down the sides with a shovel to eliminate glazing, transferring the material to the low side of the slope and creating the preferred slope. The sides of the pit may be scarified if needed. Avoid creating smooth or “glazed” sides of the pit. See **Figure 1, Recommended Tree Planting Detail**. Dispose of any unsuitable subsoil removed from excavations. The bottom of the hole should be flat and firm to prevent settling; do not dig or scarify. See **Figure 2, Tree Planting Within Right of Way Detail** for recommended planting practices where the City of Durham Director of Public Works, or designee, has approved this location for street trees. Contact the City’s Urban Forester for more detail on this practice when applicable.
- (3) After digging plant holes, confirm that water drains out of the soil by filling with water and allowing it to percolate out before setting trees and shrubs. If drainage is a problem, lower the planting hole depth and provide an alternative drainage system.
- (4) Install a sufficient quantity of planting mix to replace the removed topsoil and to achieve positive drainage at a minimum of 1.5% slope.
 - (a) The replacement soil should be the following planting mix for most plants: 10% - 30% sterile well pulverized red clay, 30% - 50% silt, 30% - 45% coarse sand, 1.0 mm to 0.5 mm in diameter, minimum 5% organic material such as completely decomposed compost/humus. The acidity range of the plant mix should be pH5.5 to pH7.0. The planting mix should have the following nutrients at the specified percent base saturation: calcium at 55% to 80%, magnesium at 10% to 30%, and potassium at 5% to 8%.
 - (b) If the quality of planting mix seems questionable to the Landscape/Site Inspector, the Inspector may require the results of a soil test for analysis.
- (5) If native soil is to be used in lieu of replacement planting mix, thoroughly pulverize the soil, minus the sod, removed from the planting hole or plant bed. Remove any clay lumps, roots or other foreign matter. Test the soil to determine what nutrients may be needed and in what amounts. Amend with lime and fertilizer according to the soil test, at the rates specified on the packages or in accordance with **Subsection 4E**.

D. Plant Installation

- (1) Soak all container plants with water before removing them from their containers to keep the plant moist and healthy during the planting process.
- (2) Remove groundcover and shrubbery from their containers. If their root balls are pot-bound, scarify the ball before installation.
- (3) Set plants upright, plumb, and oriented to provide the best appearance and relationship to the viewer, each other or adjacent structure.

- (4) Set trees and shrubs two (2) to three (3) inches above finished grade. Do not place backfill soil on top of the root ball, or up the stems or trunks of plant material. Use large equipment as needed to properly set trees in pits. Do not bend trunk or use trunk as a lever to move tree ball in pit. Any operations observed using these methods will cause immediate rejection of that plant material.
- (5) Backfill around the root ball of container plants, being careful not to pack tightly but filling in all air pockets. Do not use muddy or frozen mixtures for backfilling. Form a two (2) inch high collar of soil around the drip zone of the individual shrub in all areas not irrigated.
- (6) Take extra care to adequately backfill B & B plants. Backfill and compact the bottom third (1/3) of the root ball. Cut away the ball ties, the top two thirds (2/3) of the wire basket, and the exposed burlap. Do not remove the burlap from under the root ball. Backfill one half (1/2) of the remaining hole with the specified planting mix, and water thoroughly. Backfill the rest of the hole with the specified planting mix; firm down to eliminate air pockets, but do not pack tightly. Build a collar of soil four (4) inches in height around the edge of the root ball to form a basin for holding water. Form the bottom of the basin at the surrounding finish grade.
- (7) Mulch with two (2) to three (3) inches of composted hardwood mulch.
- (8) Water all plants immediately after planting. See **Subsection 4F.** for more on watering.
- (9) Do not wrap tree trunks. Instead, trees should be marked in the nursery with the side facing north and oriented the same in the planting hole to avoid sun scald.

E. Fertilizing and Liming Shrubs and Trees

- (1) First determine the soil texture and infiltration rate. Addition of pine bark humus (<1/2" diameter), fully composted leaf mold, or small pea gravel to clay soils, at a minimum of 25% and a maximum of 50% by volume, will help improve drainage. This will increase supply of both water and oxygen to the plants. Peat moss, sand, hardwood bark, sawdust, wood chips and pine straw are not recommended as amendments to clay soils. Addition of these amendments will also help to raise the bed, which will both improve drainage and make the bedding plants look more attractive. Pine bark humus, composted leaf mold or peat moss will improve water retention in sandy soils if added at a minimum of 25% and a maximum of 50% by volume.
- (2) Test the soil to determine what nutrients are needed and the quantities, and if an adjustment is needed in the soil pH. Without a soils test, any application of fertilizer could be detrimental to the landscape. Over-application or application of unneeded materials is not cost effective and could result in salt injury to plants, cause nutrient imbalances unsuitable for plant growth and is environmentally unsound.
- (3) Nitrogen, phosphorous and potassium are the main nutrients tested. Calcium or magnesium may also be needed, if indicated by the soil test. Adding too much calcium will inhibit the absorption of potassium and magnesium, and many sources of calcium raise soil pH. If calcium is low, but a pH change is

undesirable, gypsum can be incorporated into the soil prior to planting according to package directions.

- (4) Fertilizers should be of a slow-release variety. It is better to apply them more often during the growing season than to apply once for the entire year, since plants will not be able to absorb the nutrients, which is not cost effective.
- (5) After determining what soil amendments (fertilizer, lime, etc.) are needed, incorporate them uniformly in the top six (6) to eight (8) inches of the native soil using a rototiller prior to planting. If replacement soil is used, amendments should be mixed into that soil prior to filling around plant materials.
- (6) Where several trees or shrubs will be planted together in the same planting bed, soil amendments should be spread uniformly over the entire bed.
- (7) Where individual plants are installed, apply granulated fertilizer as a top dressing within the drip line of each individual plant. Immediately remove any fertilizer that comes in contact with the stem, trunk or foliage of a plant. Work the fertilizer into the top two (2) inches of the soil before installing mulch.
- (8) Lime, or other amendment to change the pH, should be added according to the landscape specifications or as needed per the soil test.
- (9) Be careful to sweep up any stray nutrients, that might otherwise be washed into stormwater inlets, to avoid pollution. Washing them off hard surfaces is unacceptable. Be careful when applying nutrients around water bodies and do not to add nutrients directly into any body of water.

F. Watering Shrubs and Trees

- (1) Be sure water is free from oil, acids, salts or any other substances that are toxic or harmful to vegetation.
- (2) Water container plants thoroughly before removing from their containers to keep the plant moist and healthy during the planting process.
- (3) Water all plants immediately after planting. To water thoroughly, saturate all backfill in beds during the same day of planting. Water only by open-end hose at very low pressure to avoid erosion of soil, breaking the soil collars surrounding each plant, and/or injury to roots. Make sure plants are vertical and the top of the root ball is not below existing grade once they are watered and fully settled.
- (4) Thoroughly soak the tree root ball and adjacent prepared soil several times during the first month after planting and regularly throughout the following two summers.
- (5) Use of watering bags is encouraged, especially when trees are planted in the warmer months. The use of anti-desiccant is discouraged.

G. Mulching Shrubs and Trees

- (1) Shredded, composted hardwood (triple or double cut) is preferred as mulch. The mulch should not contain any trash or weed seeds. Pine straw may be used around plants that like high acidity and where a less formal finish is desired, such as in natural areas, when specified on the approved landscape plan. Pine bark nuggets and unshredded mulches float and often wash away easily, and are, therefore, not recommended. Uncomposted mulches rob nutrients from the soil surrounding the plant as they decompose or may “burn” young plants. Stone

mulches may compact and decrease moisture to new plantings while reflecting heat, and should be limited to unique site conditions where other mulches cannot be used and these conditions will be tolerated.

- (2) Apply mulch in a two (2) to three (3) inch layer within two days of planting.
- (3) Do not spread mulch closer than six (6) inches to the trunk of a tree or against the main stems of shrubs. After watering, rake mulch to provide a uniform, finished surface.

H. Staking Trees

- (1) Staking for support is generally not recommended for large (2 1/2 inch caliper to 6 inch caliper) B & B trees if the tree is planted using the methods described in this Appendix. However, because the trunks are exposed, it may be necessary to place 3 stakes around the tree at the edge of the root ball for protection of the trunk of the tree. Use stakes that are tall enough to be seen easily. Finally, when using stakes for protection, do not attach wire or rope to the trees.
- (2) Do not stake trees less than two (2) inch caliper and shrubs less than eight feet in height.
- (3) Under unusual conditions (such as high winds, steep slopes, etc.), staking may be used with the Landscape/Site Inspector's approval. In this case, stake trees using two (2) 1"x 2"x18" minimum size wood stakes on opposing sides of the tree, perpendicular to the prevailing wind direction. Drive anchors into undisturbed soil and never through the root ball. Loosely attach individual, flexible straps, or rope fed through a rubber hose at the trunk, to prevent damage to the bark. Do not attach strapping or hose to the tree trunk.
- (4) The stakes should offer support, but also not bind or bend the tree, because flexibility of the trunk is essential for its future growth and development. Generally, after the first growing season the tree will be able to support itself and stakes should be removed.

I. Pruning Techniques for Trees

- (1) Remove water sprouts.
- (2) Remove crossing branches which rub against other branches. The rubbing weakens the growth of both branches.
- (3) Remove branches which grow at a sharp angle to the trunk. The sharp angle is a weak angle of attachment and may cause a weakened limb to split from the trunk, or cause rot by giving water a place to collect.
- (4) Remove parallel branches (those branches which attach to the trunk one above the other within inches up the trunk).
- (5) Remove all branches up to six (6) feet (deciduous, single-stemmed trees only) above the ground.
- (6) Remove any branch competing with the central leader (single-stemmed trees only). If left on the tree it may cause the development of two leaders, and waste available growth energy. Later, as each leader gets larger, the fork may split and damage the tree.
- (7) Remove any dead or broken branches.

- (8) The historical practice of removing one-third of the canopy to compensate for digging B&B plants is no longer recommended. The plants need as many leaves as possible to recover from the shock of digging and transplanting. Such pruning will be grounds for disapproval of a plant by the Landscape/Site Inspection staff.

J. Turf

- (1) Tall fescues, including Kentucky 31, are not permitted, especially when planted in areas that drain to streams or wetlands. See **Table 5, Plants Prohibited for Any Use**. See also **Subsection K. Native Grasses**, below, for more information about planting native grasses.
- (2) Winter cover crops are often specified if the prime season for planting of permanent grasses has not arrived when turf must be planted. Winter rye grain (not ryegrass), barley,
- (2) At the time of turf installation, fine-grade the surface relatively smooth and with a maximum of one (1) foot vertical to three (3) feet horizontal difference in elevation.
- (3) Incorporate lime and fertilizer, in accordance with soil tests and the rates specified on the package, in the top six (6) to eight (8) inches of the soil using a rototiller, being careful to sweep up any nutrients that land outside lawn areas on pavement or other surfaces that drain to water bodies or stormwater inlets.
- (4) Remove all rocks larger than one-half (1/2) inch in size and other debris.
- (5) Use a rake to create a smooth and level bed free of hollows and depressions and soil particles no larger than pea size.
- (6) Water to settle the soil, and rake again to break the crusty surface before seeding.
- (7) Apply seed at the specified rate on the plan, as appropriate to the season of the year. Seed may be applied with asphalt tack, which often consists of a slurry of nutrients, seeds and asphalt that appears to aid in the germination rate of the seed and serves as mulch. If not applied with asphalt tack, weed-free straw or other erosion control measure should be applied to the seeded area within hours after seeding and before any heavy rains or high winds.
- (8) Take precautions to keep foot traffic from walking directly on seeded areas until after the first mowing.
- (9) Sod installation:
 - (a) Spread 4 inches of topsoil and cultivate entire area to a depth of four (4) to six (6) inches.
 - (b) Spread lime and fertilizer over cultivated topsoil (as per specifications on package and the results of soil testing) and hand rake to smooth finish grade. As with seeding, be careful to sweep up any lime or fertilizer that lands on pavement or other surfaces that drain to water bodies or stormwater inlets to minimize pollution.
 - © Thoroughly water area to be sodded prior to installation.
 - (d) Lay sod, roll and water thoroughly.

K. Native Grasses

Native grasses should be used on the outside of stream buffer strips, where stream buffers are disturbed (e.g. for road or utility crossings) and in any areas that drain to wetlands or streams. Establishment of native grasses requires proper timing and bed preparation. Often a cover crop of barley or other non-invasive temporary legumes or grasses is used until the spring planting season. The following native grasses can be used in place of tall fescue (all are warm season grasses and perennial). The added bonus is that most have nice fall color, persist through the winter and only need cutting once a year in the spring:

Andropogon gerardii – Big Bluestem – clumping, not tolerant of wet soils, taller than little bluestem. 10-12 lbs of pure live seed (about double bulk seed). Seed from April 15-May 30. Soil pH 5.4-6.2.

Panicum virgatum – Switchgrass – useful in both wet and dry areas, good for erosion control and re-vegetation of large areas, but does poorly on heavy soils. Need to completely eradicate competing grasses and weeds for best survival. Varieties Blackwell, Heavy Metal, Alamo, Kanlow, Shelter, needs pH of 5. Drill seeded on large acreage and can be broadcast on smaller plots at 5-10 lbs/acre depending upon the seed (live or bulk). 10 lbs/acre conventional planting (live seed) recommended; 8 lbs/acre drilled. Do not use nitrogen at seeding time, because it will stimulate weed growth. Phosphorus and potassium should be applied according to soil tests before or at seeding.

Pennisetum glaucum – Brown Top or Pearl Millet – Fast-growing, robust, annual grass with good drought tolerance. Good for warm season soil stabilization.

Schizachyrium scoparium – Little Bluestem – clumping, not tolerant of wet soils. 10-12 lbs of pure live seed per acre (about double bulk seed). Seed from April 15-May 30. Soil pH 5.4-6.2.

Tridens flavus – Purple-Top – dry areas best. Seed in the Spring. 10-15 lbs pure live seed per acre is sufficient for drill seeding. Broadcast seeding should be 20-25 lbs pure live seed per acre.

Annual winter cover, if needed, should be planted in early to late fall at the rate of 50-60 lbs/acre if drilled or 60-100 lbs/acre broadcast. Winter rye or rye grain (not rye grass) (*Secale cereale*, *S. cereale* *abruces*, *S. cereale* Winter Grazer 70) or barley (*Hordeum vulgare*, *H. jubatum*, *H. murinum*, or *H. pusillum*) are recommended until ground is warm enough to plant with permanent cover.

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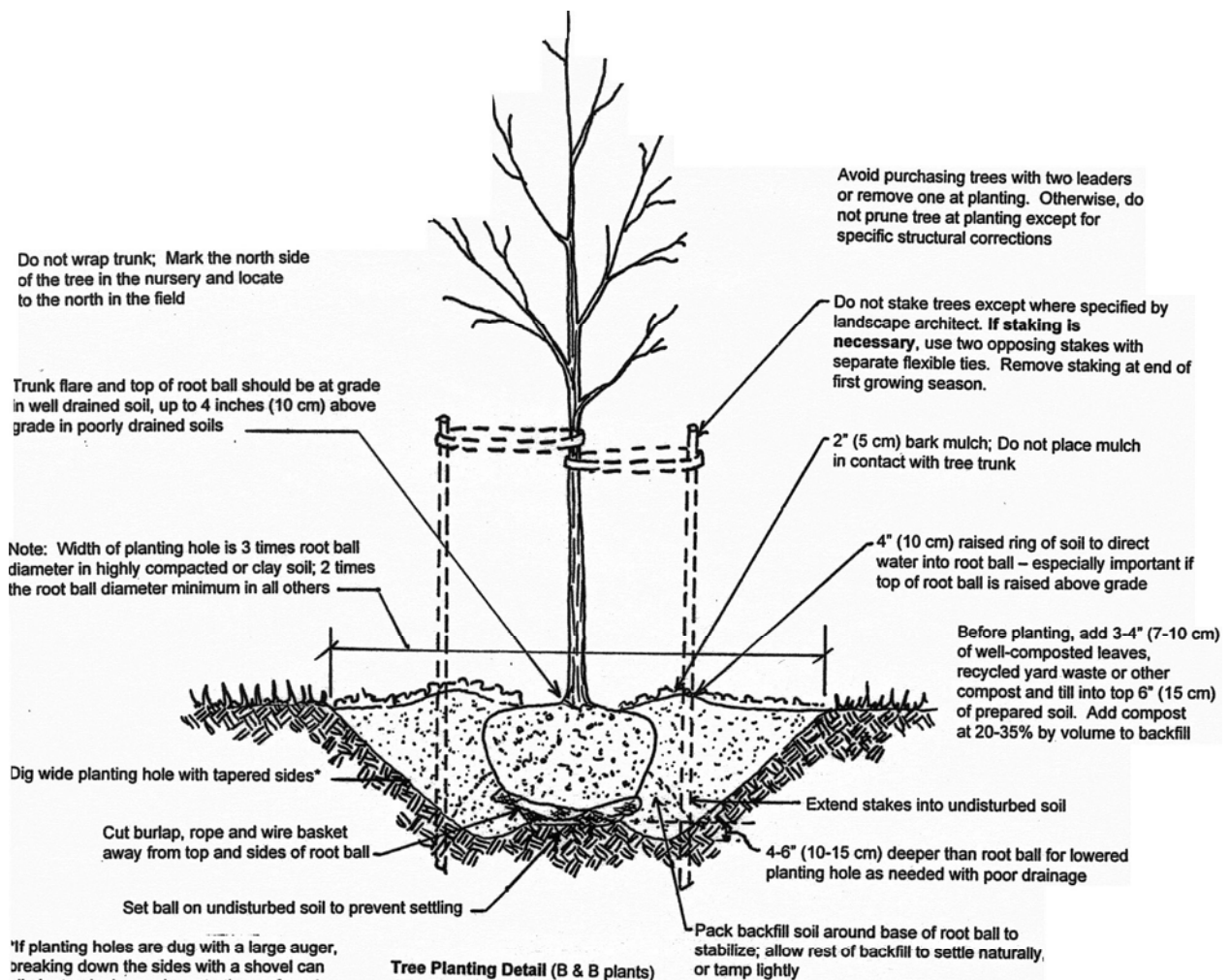
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Figure 1, Tree Planting Detail



*If planting holes are dug with a large auger, breaking down the sides with a shovel can eliminate glazing and create the preferred sloping side.

Tree Planting Detail (B & B plants)
Adapted from "Architectural Graphic Standards" 1998 and Watson & Himelick "Principles and Practice of Planting Trees and Shrubs" 1997

NOTES

1. Where several trees will be planted close together such that they will likely share root space, till in soil amendments to a depth of 4-6" (10-15 cm) over the entire area.
2. For container-grown trees, use fingers or small hand tools to pull the roots out of the outer layer of potting soil; then cut or pull apart any roots circling the perimeter of the container.
3. During the design phase, confirm that water drains out of the soil; use lowered planting hole depth and design alternative drainage system as required.
4. Thoroughly soak the tree root ball and adjacent prepared soil several times during the first month after planting and regularly throughout the following two summers.
5. The planting process is similar for deciduous and evergreen trees.

PLAN VIEW

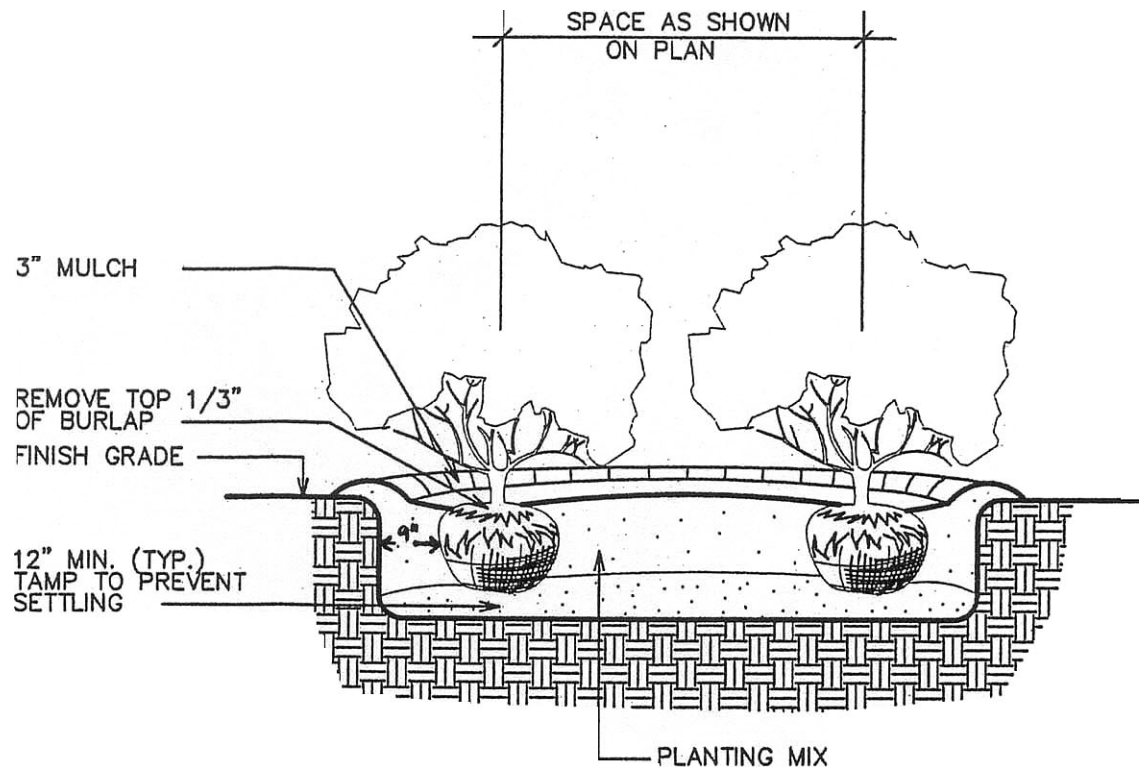
SECTION VIEW

PLAN VIEW 2

1 TREE PLANTING DETAIL ALONG ROADWAYS

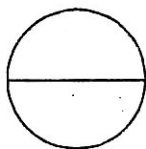
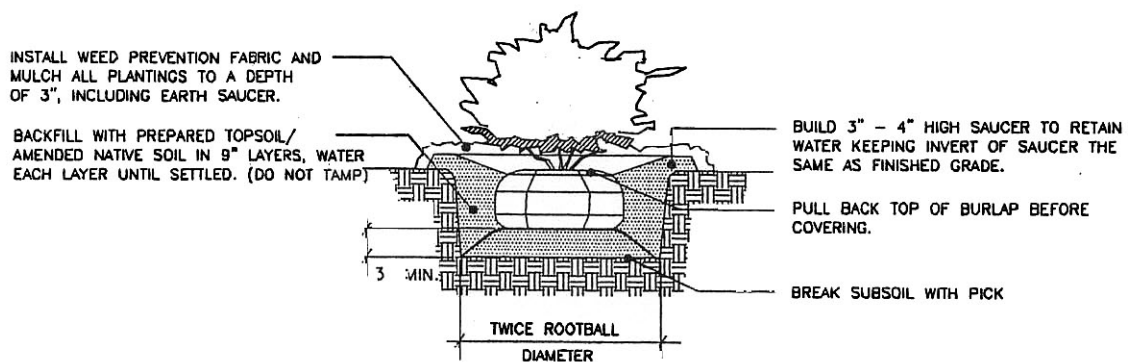
NOT TO SCALE

Figure 3, Shrub Planting Detail



SHRUB/GROUND COVER PLANTING DETAIL

NOT TO SCALE



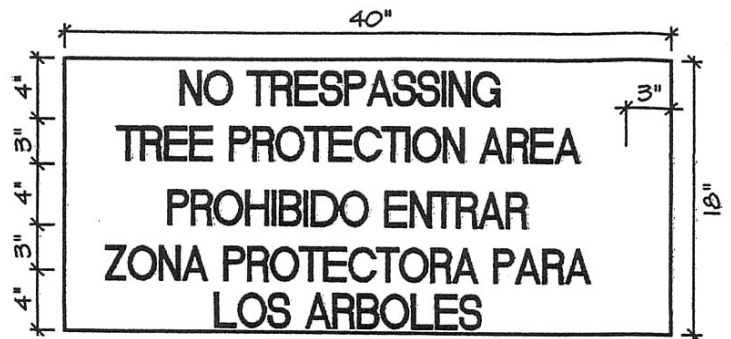
SPECIMEN SHRUB PLANTING DETAIL

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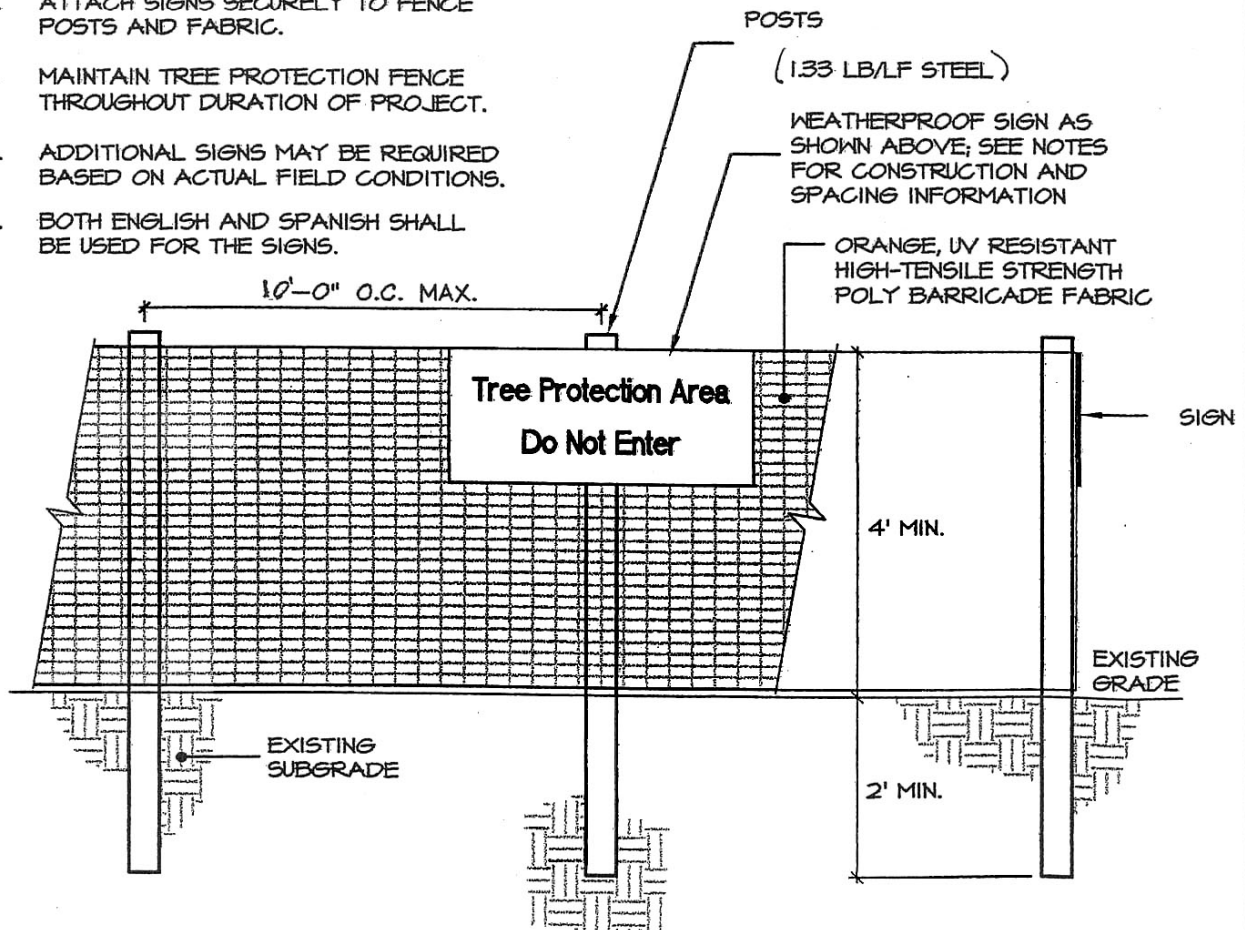
Figure 4, Tree Protection Fence Detail

NOTES:

1. WARNING SIGNS SHALL BE MADE OF DURABLE WEATHERPROOF MATERIAL.
2. LETTERS SHALL BE 3" HIGH MINIMUM, CLEARLY LEGIBLE, AND SPACED AS SHOWN.
3. SIGNS ARE TO BE PLACED NO GREATER THAN 100 FT. ON CENTER.
4. PLACE SIGN AT EACH END OF LINEAR TREE PROTECTION AREAS AND 100 FT. ON-CENTER THEREAFTER.
5. FOR TREE PROTECTION AREAS LESS THAN 100 FT. IN PERIMETER, PROVIDE NO LESS THAN ONE SIGN PER AREA.
6. ATTACH SIGNS SECURELY TO FENCE POSTS AND FABRIC.
7. MAINTAIN TREE PROTECTION FENCE THROUGHOUT DURATION OF PROJECT.
8. ADDITIONAL SIGNS MAY BE REQUIRED BASED ON ACTUAL FIELD CONDITIONS.
8. BOTH ENGLISH AND SPANISH SHALL BE USED FOR THE SIGNS.



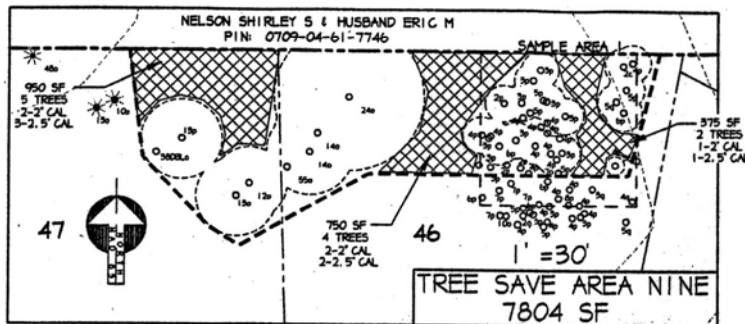
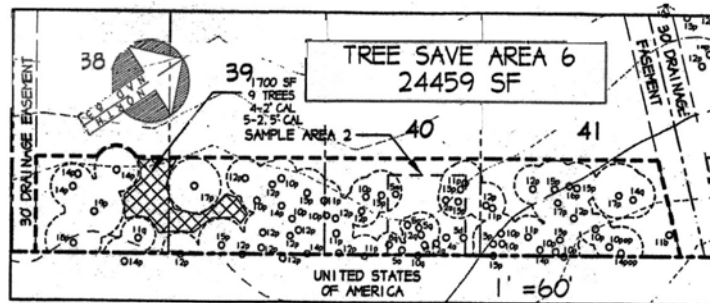
SIGN DETAIL
NO SCALE



INSTALL TREE PROTECTION FENCE & SIGNAGE PRIOR TO CALLING FOR THE INITIAL ON-SITE INSPECTION

TREE PROTECTION FENCE

Figure 5, Sample Area Example



AREA #	SAVE ROOT ZONE AREA	REPLANTING ADDITIONAL TREES				AREA CREDIT	TOTAL AREA SF	MINIMUM DIMENSION
		2' CAL #	175 SF	2.5' CAL #	200 SF			
1	96230 SF	41	7175	41	8200	15375 SF	111605 SF	25 LF
2	15127 SF	0	0	0	0	0 SF	15127 SF	25 LF
3	57879 SF	27	4725	28	5600	10325 SF	68204 SF	25 LF
4	6131 SF	8	1400	8	1600	3000 SF	9131 SF	25 LF
5	17000 SF	14	2450	14	2800	5250 SF	22250 SF	25 LF
6	22759 SF	4	700	5	1000	1700 SF	24459 SF	25 LF
7	10675 SF	13	2275	14	2800	5075 SF	15748 SF	25 LF
8	6863 SF	0	0	0	0	0 SF	6863 SF	25 LF
9	5729 SF	5	875	6	1200	2075 SF	7804 SF	25 LF
TOTAL	236391 SF	112	19600	116	23200	42800 SF	281191 SF	

SAMPLING AREAS														
AREA 1			AREA2			AREA 3			AREA 4			AREA 5		
SIZE	TYPE	QTY	SIZE	TYPE	QTY	SIZE	TYPE	QTY	SIZE	TYPE	QTY	SIZE	TYPE	QTY
2'	PINE	3	13'	PINE	3	5'	PINE	2	2'	PINE	12	2'	PINE	1
3'	PINE	12	12'	PINE	1	8'	PINE	2	3'	PINE	20	4'	PINE	1
4'	PINE	18	11'	PINE	1	9'	PINE	1	4'	PINE	1	5'	PINE	2
5'	PINE	7	10'	PINE	1	10'	PINE	1	3'	GUM	5	6'	PINE	1
6'	PINE	4	2'	OK	1	11'	PINE	3	4'	GUM	1	7'	PINE	2
7'	PINE	6	4'	OK	1	12'	PINE	2	2'	MAPLE	1	8'	PINE	1
8'	PINE	1	5'	OK	2	13'	PINE	1	3'	MAPLE	1	10'	PINE	2
2'	CEDAR	1	2'	SHEET GUM	2	14'	PINE	1	4'	MAPLE	1	11'	PINE	2
3'	CEDAR	1	5'	SHEET GUM	1	15'	PINE	2				13'	PINE	1
10'	OK	1	8'	SHEET GUM	1	16'	PINE	1				14'	PINE	3
2'	GUM	1	10'	SHEET GUM	1	18'	PINE	1				16'	PINE	1
3'	GUM	1	12'	SHEET GUM	1	3'	OK	1				2'	OK	4
4'	GUM	1	5'	MAPLE	1	4'	OK	1				3'	OK	6
5'	GUM	2				20'	OK	1				4'	OK	2
						2'	ASH	2				5'	OK	4
						3'	ASH	5				6'	OK	1
						4'	ASH	2				8'	OK	1
						5'	ASH	1				2'	MAPLE	2
						2'	SHEET GUM	2				3'	MAPLE	2
						3'	SHEET GUM	11				4'	MAPLE	2
						4'	SHEET GUM	3				4'	GUM	1
						3'	DOSHOOD	1				5'	GUM	1
												6'	GUM	1

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Table 1, Recommended Trees

Scientific Name	Common Name	Tree Type (See Note 1)	Use Categories (See Section 5.A.)								Native to Durham	Riparian Buffers	Drought Tolerant (See Note 2)	Notes
			Suburban Street	Urban/Downtown / Compact Street**	Street Trees/ Power Lines	Parking Lots	Buffers/ Natural	Tree Coverage	Urban Screens/ Buffers	Urban Public/ Open Spaces**				
<i>Acer barbatum (floridanum)</i>	Southern sugar maple, Florida maple	CT	Y				Y	Y	Y		Y	Y	Y	
<i>Acer buergeranum</i>	Trident maple	DU		Y/D **	Y	Y	Y	Y	Y	Y				
<i>Acer buergeranum</i> 'ABTIR'	Street Wise ® Trident maple	CT		Y/D **	Y			Y	Y					
<i>Acer buergeranum</i> 'Aeryn'	Aeryn Trident maple	DU		Y/D **	Y	Y	Y	Y	Y					
<i>Acer campestre</i>	Hedge maple	CT			Y	Y	Y	Y	Y					Often multi-stemmed
<i>Acer campestre</i> 'Queen Elizabeth'	Queen Elizabeth maple	DU			Y	Y	Y	Y	Y					
<i>Acer griseum</i>	Paperbark maple	DU			Y				Y	Y				Upright, narrow
<i>Acer leucoderme</i>	Chalkbark or whitebark maple	DU			Y		Y	Y	Y					Often multi-stemmed
<i>Acer palmatum</i>	Japanese maple (many varieties also)	DU			Y					Y				Often a specimen
<i>Acer palmatum</i> 'Bloodgood'	Bloodgood Japanese maple	DU		Y						Y				Slow growing, eventually reaching 20 feet.
<i>Acer rubrum</i>	Red maple	CT					Y	Y	Y		Y			Cultivars preferred for consistency

Y= Yes or recommended. * Should only be used where there is sufficient room for such a large tree.

** D= Recommended for use in the Downtown Design Overlay District and in the Downtown and Compact Neighborhood Tiers.

(1) Tree Types: CT = Canopy Tree; DU= Deciduous Understory Tree; ET= Evergreen Tree; EU= Evergreen Understory Tree

(2) Drought Tolerant, per NC Cooperative Extension Service: Y= Requires low/ no irrigation once established.

Table 1, Recommended Trees

Scientific Name	Common Name	Tree Type (See Note 1)	Use Categories (See Section 5.A.)								Native to Durham	Riparian Buffers	Drought Tolerant (See Note 2)	Notes
			Suburban Street	Urban/Downtown / Compact Street**	Street Trees/ Power Lines	Parking Lots	Buffers/ Natural	Tree Coverage	Urban Screens/ Buffers	Urban Public/ Open Spaces**				
<i>Acer rubrum</i> 'October Glory'	October Glory red maple	CT	Y*			Y	Y	Y*			Y			Needs space
<i>Acer rubrum</i> 'Frank's Red'	Red sunset maple	CT	Y	Y		Y	Y	Y		Y/D	Y			Smaller than other red maples
<i>Acer rubrum</i> 'Autumn Blaze'	Autumn Blaze red maple	CT	Y*	Y*/D*		Y	Y	Y*		Y/D*	Y			Needs space
<i>Acer rubrum</i> 'Columnare'	Columnar red maple	CT	Y	Y*/D*		Y	Y	Y	Y		Y			Narrow, upright
<i>Acer rubrum</i> 'Bowhall'	Bowhall red maple	CT	Y	Y/D		Y		Y	Y		Y			Narrow, upright
<i>Acer saccharum</i>	Sugar maple	CT	Y*				Y	Y*		Y*	Y	Y		Needs space
<i>Acer saccharum</i> 'Legacy'	Legacy sugar maple	CT	Y	Y		Y	Y	Y	Y*	Y/D	Y	Y		More narrow than species
<i>Acer truncatum</i> 'Keithsform'	Norwegian Sunset TM maple	CT	Y	Y*			Y	Y	Y	Y				
<i>Amelanchier arborea</i>	Serviceberry	DU			Y		Y	Y	Y		Y	Y		Multi-stemmed, shrubby
<i>Amelanchier</i> spp. Cultivars 'Autumn Brilliance', 'Princess Diana', 'Robin Hill', Spring Glory TM , Tradition TM	Serviceberry cultivars	DU			Y		Y	Y	Y		Y	Y		Multi-stemmed, shrubby
<i>Asimina tribloba</i>	Pawpaw	DU					Y	Y			Y	Y		Prefers moist sites; edible fruit

Y= Yes or recommended. * Should only be used where there is sufficient room for such a large tree.

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Scientific Name	Common Name	Tree Type (See Note 1)	Use Categories (See Section 5.A.)								Native to Durham	Riparian Buffers	Drought Tolerant (See Note 2)	Notes
			Suburban Street	Urban/Downtown / Compact Street**	Street Trees/ Power Lines	Parking Lots	Buffers/ Natural	Tree Coverage	Urban Screens/ Buffers	Urban Public/ Open Spaces**				
<i>Betula nigra</i>	River birch	CT					Y	Y*			Y	Y		Multi-stemmed or single
<i>Betula nigra</i> 'BNMTF'	Dura-Heat ® River birch	CT					Y	Y		Y	Y	Y		Multi-stemmed
<i>Betula nigra</i> 'Heritage'	Heritage river birch	CT	Y			Y	Y	Y*	Y		Y	Y		Prefers some shade
<i>Carpinus betulus</i>	European hornbeam	CT	Y			Y	Y		Y				Y	Species needs more space than cultivars
<i>Carpinus betulus</i> 'Fastigiata'	European hornbeam	CT	Y	Y		Y		Y	Y				Y	
<i>Carpinus caroliniana</i>	American hornbeam	CT		Y/D		Y	Y	Y	Y		Y	Y	Y	Difficult to transplant
<i>Carya cordiformis</i>	Bitternut hickory	CT									Y	Y*		Needs space
<i>Carya glabra</i>	Pignut hickory	CT									Y	Y*	Y	Needs space
<i>Carya ovata</i>	Shagbark hickory	CT									Y	Y		Needs space
<i>Carya tomentosa</i>	Mockernut hickory	CT									Y	Y	Y	Needs space
<i>Cedrus deodara</i>	Deodar cedar	ET					Y*			Y*				Needs space; excellent specimen tree
<i>Celtis laevigata</i>	Sugar hackberry	CT	Y*				Y	Y*	Y		Y	Y		Needs space

Y= Yes or recommended. * Should only be used where there is sufficient room for such a large tree.

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			Suburban Street	Urban/Downtown / Compact Street**	Street Trees/ Power Lines	Parking Lots	Buffers/ Natural	Tree Coverage	Urban Screens/ Buffers	Urban Public/ Open Spaces**				
<i>Celtis occidentalis</i> 'Prairie's Pride'	Prairie Pride hackberry	CT	Y*				Y	Y*					Y	More compact than species in youth
<i>Cercis canadensis</i>	Eastern redbud	DU			Y		Y				Y	Y		Cultivars more disease resistant
<i>Cercis canadensis</i> 'Forest Pansy'	Forest Pansy redbud	DU			Y		Y	Y	Y	Y/D	Y	Y		
<i>Cercis canadensis</i> 'Flame' 'Ruby Atkinson'	Flame and Ruby Atkinson redbuds	DU			Y		Y	Y			Y	Y		
<i>Cercis chinensis</i> 'Avondale'	Avondale Redbud	DU		Y	Y									
<i>Cercis reniformis</i>	Texas redbud	DU			Y		Y							
<i>Cercis reniformis</i> 'Oklahoma' 'Texas White'	Oklahoma and Texas White redbuds	DU		Y	Y		Y							
<i>Chionanthus virginicus</i>	Fringetree	DU				Y	Y	Y	Y		Y	Y		Tree form only
<i>Cornus florida</i>	Flowering dogwood	DU					Y				Y	Y		Cultivars more disease resistant
<i>Cornus florida</i> cultivars 'Cherokee Chief', 'Cloud 9', 'White Cloud', 'Rubra'	Flowering dogwood cultivars	DU					Y	Y			Y	Y		
<i>Cornus kousa</i>	Kousa or Japanese dogwood	DU			Y		Y	Y	Y	Y/D				Milky Way Select' best as single stem

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Table 1, Recommended Trees

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			Suburban Street	Urban/Downtown / Compact Street**	Street Trees/ Power Lines	Parking Lots	Buffers/ Natural	Tree Coverage	Urban Screens/ Buffers	Urban Public/ Open Spaces**				
<i>Corylus colurna</i>	Turkish filbert or hazel	CT	Y*					Y*	Y*	Y*			Y	"Formal"
<i>Cotinus coggygia</i>	Smoke tree	DU			Y		Y	Y	Y				Y	Multi-stemmed; shrubby
<i>Cryptomeria japonica</i> 'Yoshino'	Japanese cedar	ET					Y*		Y*	Y*				Needs space
<i>Diospyros virginiana</i>	Persimmon	CT					Y*				Y*	Y	Y	Needs space; some leaf spot problems
<i>Fagus grandiflora</i>	American beech	CT					Y*	Y*			Y	Y		Needs space; shades out all others; needs irrigation
<i>Fraxinus pennsylvanica</i> 'Marshall's Seedless', 'Patmore', 'Summit'	Green ash cultivars	CT					Y		Y		Y	Y	Y	Borers seem to be a problem, even with the cultivar
<i>Fraxinus profunda</i>	Pumpkin ash	CT									Y	Y*		Needs space; prefers moist sites; some diseases
<i>Ginkgo biloba</i> 'Autumn Gold', 'Saratoga'	Ginkgo cultivars (male only)	CT		Y		Y		Y		Y				

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<i>Ginkgo biloba</i> 'PNI 2720'	Princeton Sentry ® ginkgo	CT		Y*		Y		Y		Y				
<i>Gleditsia triacanthos</i> var. <i>inermis</i> 'Shademaster', 'Skyline'	Thornless honeylocust varieties -Shademaster®, Skyline®	CT	Y	Y		Y		Y						Many insect and disease problems
<i>Halesia carolina</i> (tetraptera)	Carolina silverbell, snowdrop tree	DU					Y	Y	Y		Y	Y	Y	
<i>Ilex cornuta</i> 'Burfordii'	Burford holly	ET					Y	Y	Y	Y/D			Y	Can be trained to tree form
<i>Ilex cornuta</i> 'Burfordii Nana'	Dwarf burford holly	EU					Y		Y	Y			Y	Can be trained to tree form
<i>Ilex opaca</i>	American holly	ET					Y	Y	Y		Y	Y		
<i>Ilex vomitoria</i>	Yaupon holly	EU					Y		Y	Y/D			Y	Upright or weeping
<i>Ilex x attenuata</i> hybrids 'East Palatka', 'Foster's No.2'	Hybrid hollies	ET			Y		Y	Y	Y		Y			
<i>Ilex x attenuata</i> 'Savannah'	Savannah holly	ET			Y		Y	Y	Y		Y		Y	
<i>Ilex x</i> 'Nellie R. Stevens'	Nellie Stevens holly	ET			Y		Y	Y	Y	Y/D	Y		Y	
<i>Juniperus virginiana</i>	Eastern red cedar	ET			Y		Y	Y	Y		Y	Y	Y	Doesn't tolerate wet sites; needs full sun

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<i>Juniperus virginiana</i> 'Brodie'	Brodie Juniper	ET			Y		Y	Y	Y		Y	Y	Y	Doesn't tolerate wet sites; needs full sun
<i>Koelreuteria paniculata</i>	Goldenraintree	DU		Y	Y	Y	Y	Y	Y				Y	
<i>Koelreuteria paniculata</i> 'September'	September goldenraintree	DU		Y	Y	Y	Y	Y	Y	Y/D			Y	
<i>Lagerstroemia indica</i> cultivars, 'Sarah's Favorite'	Crape myrtle cultivars	DU		Y/D	Y	Y		Y	Y				Y	Tree form only; may not be used for street trees on suburban sites
<i>Lagerstroemia indica</i> 'Byers Standard Red', 'Byers Wonderful White', 'Lipan', 'Seminole', 'Potomac'	Crape myrtle cultivars	DU		Y	Y	Y		Y	Y	Y/D			Y	Tree form only; may not be used for street trees on suburban sites
<i>Lagerstroemia indica</i> 'Whit II'	Dynamite™ crape myrtle	DU			Y	Y		Y	Y					Tree form only; may not be used for street trees on suburban sites

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			Suburban Street	Urban/Downtown / Compact Street**	Street Trees/ Power Lines	Parking Lots	Buffers/ Natural	Tree Coverage	Urban Screens/ Buffers	Urban Public/ Open Spaces**				
<i>Lagerstroemia indica</i> x <i>Lagerstroemia faurei</i> : 'Lipan', 'Osage', 'Sioux'	Crape myrtle cultivars	DU		Y	Y	Y		Y	Y					Tree form only; may not be used for street trees on suburban sites
<i>Lagerstroemia indica</i> x <i>Lagerstroemia faurei</i> : 'Biloxi', 'Choctaw', 'Miami', 'Muskogee', 'Natchez', 'Tuscarora', 'Tuskegee'	Crape myrtle cultivars	DU			Y	Y		Y	Y					Tree form only; may not be used for street trees on suburban sites
<i>Lagerstroemia faurei</i> 'Fantasy'	Fantasy Crape myrtle	DU			Y	Y		Y	Y	Y				Tree form only; may not be used for street trees on suburban sites
<i>Liquidambar styraciflua</i> 'Rotundiloba'	Fruitless sweetgum	CT	Y*	Y/D*			Y*	Y*		Y/D*	Y	Y	Y	Needs space
<i>Liriodendron tulipifera</i>	Tulip poplar	CT					Y*				Y	Y	Y	Too large for most sites
<i>Magnolia acuminata</i>	Cucumber magnolia	ET									N	Y*		Needs space
<i>Magnolia grandiflora</i>	Southern magnolia	ET	Y*				Y*	Y*	Y*		Y			Needs space
<i>Magnolia grandiflora</i> 'Ann'	Ann magnolia	EU		Y	Y		Y	Y	Y		Y			
<i>Magnolia grandiflora</i> 'TIIMG'	Alta ® magnolia	EU	Y		Y			Y	Y	Y	Y			

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<i>Magnolia grandiflora</i> 'Ballerina'	Ballerina magnolia	EU		Y	Y		Y	Y	Y		Y			
<i>Magnolia grandiflora</i> 'Betty'	Betty magnolia	EU		Y	Y		Y	Y	Y		Y			
<i>Magnolia grandiflora</i> 'Merrill'	Merrill magnolia	ET	Y		Y		Y	Y	Y		Y			
<i>Magnolia grandiflora</i> 'Little Gem'	Little Gem magnolia	EU			Y		Y	Y	Y	Y	Y/D			
<i>Magnolia grandiflora</i> 'Bracken's Brown Beauty'	Bracken's Brown Beauty Magnolia	ET	Y				Y	Y	Y	Y	Y/D			
<i>Magnolia grandiflora</i> 'Claudia Wannamaker', 'D.D. Blanchard'	Claudia Wannamaker Magnolia, D.D. Blanchard Magnolia	ET	Y*				Y*	Y*		Y*	Y			Pyramidal form, but needs space
<i>Magnolia stellata</i>	Star magnolia	DU			Y		Y	Y	Y					Avoid southern exposure
<i>Magnolia tripetala</i>	Umbrella tree	DU										Y		Vigorous, unkempt
<i>Magnolia virginiana</i>	Sweetbay magnolia	EU					Y	Y			Y	Y		Prefers wetter sites
<i>Magnolia x soulangiana</i>	Saucer magnolia	DU					Y	Y	Y				Y	
<i>Magnolia x soulangiana</i> 'Jane'	Jane saucer magnolia	DU				Y	Y	Y	Y				Y	

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<i>Malus</i> spp. Hybrids 'Adirondack', 'David', <i>floribunda</i> , 'Prairiefire', 'Sugar Tyme' ®	Flowering crab apple hybrids	DU			Y									Do not plant with junipers; cultivars more disease resistant
<i>Metasequoia glyptostroboides</i>	Dawn redwood	ET	Y*											Needs space
<i>Myrica cerifera</i>	Wax myrtle	EU			Y		Y	Y	Y			Y	Y	Can be trained to tree form
<i>Nyssa sylvatica</i>	Black gum	CT	Y*				Y*				Y	Y*		Too large for most sites
<i>Nyssa sylvatica</i> var. <i>biflora</i>	Swamp tupelo	CT									Y	Y*		Prefers wetter sites
<i>Ostrya virginiana</i>	Eastern hophornbeam, ironwood	DU		Y		Y	Y	Y	Y	Y	Y	Y		Tolerates city conditions
<i>Oxydendron aboreum</i>	Sourwood	DU					Y	Y			Y	Y	Y	
<i>Parrotia persica</i>	Persian parrotia	CT		Y		Y	Y	Y	Y	Y				Single stem preferred as street trees
<i>Pinus taeda</i>	Loblolly pine	ET					Y	Y	Y		Y		Y	
<i>Pistacia chinensis</i>	Chinese pistachio	CT	Y	Y/D		Y		Y	Y	Y			Y	
<i>Populus deltoides</i>	Eastern cottonwood	CT										Y*		Needs space; prefers wetter sites

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<i>Prunus caroliniana</i> 'Bright N Tight'	Carolina cherry laurel	ET			Y		Y	Y	Y		Y	Y	Y	Tree form only
<i>Prunus mume</i>	Japanese apricot	DU		Y	Y		Y	Y	Y	Y				Best in groupings
<i>Prunus sargentii</i>	Sargent cherry	CT	Y	Y*				Y		Y*				
<i>Prunus sargentii</i> 'Columnaris'	Upright Sargent cherry	DU		Y				Y	Y	Y				
<i>Prunus subhirtella</i>	Higan cherry	CT		Y			Y	Y	Y	Y				Best in groupings
<i>Prunus x yedoensis</i> 'Akebono'	Akebono cherry	DU		Y			Y	Y	Y	Y/D				
<i>Quercus alba</i>	White oak	CT									Y	Y*	Y	Needs space
<i>Quercus bicolor</i>	Swamp White Oak	CT									Y	Y*		Needs irrigation, prefers wetter sites
<i>Quercus coccinea</i>	Scarlet oak	CT	Y*			Y*	Y*	Y*	Y*	Y*/D	Y	Y		Needs space
<i>Quercus falcata</i>	Southern red oak	CT	Y*				Y*	Y*	Y*		Y	Y		Needs space
<i>Quercus lyrata</i>	Overcup oak	CT	Y*				Y*	Y			Y	Y		Needs space, irrigation
<i>Quercus lyrata</i> 'QLFTB'	Highbeam® Overcup Oak	CT	Y			Y	Y	Y		Y*	Y			
<i>Quercus michauxii</i>	Swamp Chestnut Oak	CT									Y	Y*		Needs space, irrigation

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<i>Quercus nigra</i>	Water oak	CT					Y*				Y	Y*		Needs space, irrigation; has problems with untreatable decay
<i>Quercus nuttallii (texana)</i>	Nuttall oak	CT	Y*				Y							Needs space, irrigation; not pollution tolerant
<i>Quercus nuttallii</i> 'QNFTA'	Highpoint ® Nuttall Oak	CT	Y*				Y							Needs space, irrigation; more tolerant of urban conditions than species
<i>Quercus pagoda</i>	Cherrybark oak	CT										Y		Needs space; prefers wetter sites
<i>Quercus phellos</i>	Willow oak	CT	Y*			Y*	Y*	Y*		Y*/D	Y	Y		Needs space; variable form
<i>Quercus phellos</i> 'QPSTA'	Hightower ® Willow Oak	CT	Y			Y*	Y*	Y*		Y*D	Y	Y		Needs space
<i>Quercus phellos</i> 'QPMTF'	Wynstar ® Willow oak	CT	Y	Y*		Y	Y	Y	Y*	Y*D	Y	Y		Needs space
<i>Quercus prinus</i>	Chestnut oak	CT										Y*	Y	Needs space

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<i>Quercus rubra</i>	Red oak	CT	Y*			Y*	Y*	Y*			Y	Y*		Needs space, prefers sandy loam
<i>Quercus shumardii</i>	Shumard oak	CT	Y*			Y*	Y*	Y*		Y*/D	Y	Y*	Y	Too large for most sites
<i>Quercus shumardii</i> 'QSFTC'	Panache ® Shumard Oak	CT	Y*			Y*	Y*	Y*		Y*/D	Y	Y*	Y	
<i>Quercus stellata</i>	Post oak	CT						Y*			Y	Y*	Y	Needs space, prefers sandy loam
<i>Quercus velutina</i>	Black oak	CT									Y	Y*	Y	Needs space
<i>Robinia pseudoacacia</i>	Black locust	CT										Y*		Many diseases; should be used sparingly since it may take over
<i>Sassafras albidum</i>	Sassafras	CT					Y	Y			Y	Y	Y	Tends to sprout from roots and form extensive thickets
<i>Sophora japonica</i> 'Princeton Upright', 'Regent'	Princeton Upright pagoda tree	CT	Y										Y	Can be messy
<i>Styrax japonicus</i>	Japanese snowbell	DU			Y		Y	Y						Best in partial shade

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<i>Symplocos tinctoria</i>	Horse-sugar, sweetleaf	DU										Y	Y	Suckering; semi-evergreen
<i>Taxodium distichum</i>	Bald cypress	CT	Y*			Y*	Y*	Y*	Y*			Y	Y	Needs space; deciduous conifer
<i>Taxodium distichum</i> 'Autumn Gold'	Autumn gold bald cypress	CT	Y*										Y	Needs space
<i>Tilia cordata</i>	Little leaf linden (not cultivars)	CT	Y			Y	Y	Y	Y					
<i>Tsuga caroliniana</i>	Carolina hemlock	ET										Y*		Needs space; woolly adelgid is a serious concern.
<i>Ulmus parvifolia</i>	Chinese elm	CT	Y*				Y	Y*	Y				Y	Needs space
<i>Ulmus parvifolia</i> 'Elmer I'	Athena® elm	CT	Y*	Y*			Y	Y*	Y	Y*/D			Y	Needs space
<i>Ulmus parvifolia</i> 'Elmer II'	Allee® elm	CT	Y*				Y	Y*	Y	Y*/D			Y	Needs space; larger than 'Athena'
<i>Ulmus parvifolia</i> 'UPMTF'	Bosque Elm	CT	Y*	Y*/D*		Y	Y	Y	Y	Y*/D			Y	Needs space
<i>Zelkova serrata</i>	Japanese zelkova	CT	Y			Y		Y*					Y	Needs space
<i>Zelkova serrata</i> 'Village Green', 'Green Vase'	Village Green zelkova	CT	Y			Y		Y*					Y	Needs space

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Table 2, Recommended Shrubs

Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Abelia chinensis</i>	Chinese abelia	Semi-ES	5 to 7		Y	Y	Y		Y		Sun, partial shade	Species not often planted.
<i>Abelia</i> hybrids	'Edward Goucher', 'Little Richard', 'Sunrise', 'Sherwood', etc.	Semi-ES	Varies	Y	Y	Y	Y		Y		Sun, partial shade	* 'Edward Goucher' (4'-6'); 'Prostrata' and 'Sherwood' (3'-4')
<i>Abelia x grandiflora</i>	Glossy abelia	Semi-ES	3 to 6		Y	Y	Y		Y		Sun, partial shade	*Attracts bees
<i>Abeliophyllum distichum</i>	White forsythia	DS	3 to 5		Y	Y	Y		Y		Sun, partial shade	Easily transplanted and adaptable to many soils, wide, arching, ragged
<i>Aesculus sylvatica</i>	Painted buckeye	DS/ DU	6 to 15					Y			Shade	
<i>Aesculus parviflora</i>	Bottlebrush buckeye	DS	8 to 12+		Y				Y		Sun, partial shade	Suckering, multi-stem, wide-spreading shrub.
<i>Agave americana</i>	Century plant	ES	3 to 6				Y		Y		Sun	Good accent
<i>Amelanchier canadensis</i>	Shadblow serviceberry, thicket serviceberry	DU	6 to 20		Y			Y			Sun, partial shade	Upright, suckering, tightly multi-stemmed. Native to swamps, along streams, and on hillsides. Not very pollution tolerant.

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Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Aronia arbutifolia</i>	Red chokeberry	DS	6 to 10		Y		Y	Y	Y	Y	Sun, partial shade	* 'Brilliantissima' (6'-8'), excellent fall color. Suckering, forming colonies over time, leggy. Tolerates both wet and dry soils.
<i>Aspidistra elatior</i>	Cast iron plant	ES	1.5 to 2	Y					Y		Partial shade, shade	Good in low-light areas.
<i>Aucuba japonica</i>	Aucuba	ES	6 to 10+		Y	Y	Y		Y		Partial shade	*Prefers warmer temperatures, tolerates pollution.
<i>Baccharis halimifolia</i>	Groundsel-bush	DS	5 to 12					Y	Y		Sun	Salt tolerant
<i>Berberis julianae</i>	Wintergreen barberry	ES	6 to 9		Y	Y	Y		Y		Sun, partial shade	*Hardest of evergreen barberries; thorns
<i>Berberis koreana</i>	Korean barberry	DS	4 to 6(8)		Y	Y	Y		Y		Sun, partial shade	Thorns. Extremely cold hardy and will tolerate any soil not permanently wet.
<i>Berberis triacanthophora</i>	Threespine barberry	ES	3 to 5		Y		Y		Y		Sun, partial shade	Thorny; open habit

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				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Berberis verruculosa</i>	Warty barberry	ES	3 to 6		Y		Y		Y		Sun, partial shade	*Thorny
<i>Berberis x chenaultii</i>	Chenault barberry	ES	3 to 4		Y		Y		Y		Sun	Thorny; bronze-red color in winter
<i>Berberis x gladwynensis</i> 'William Penn'	William Penn barberry	ES	3 to 4		Y	Y	Y		Y		Sun, partial shade	Thorny; dense, mounded habit; bronze winter color; temps below -10 will kill it.
<i>Berberis x mentorensis</i>	Mentor barberry	DS	5 to 7		Y		Y		Y		Sun, partial shade	*Withstands drought and heat, but prefers well-drained soil; thorny stems
<i>Buddleia alternifolia</i>	Alternate-leaf butterfly-bush	DU	10 to 20		Y		Y		Y		Sun	Very hardy and first to flower; prefers loose, loamy soils. Can be used as a small tree.
<i>Buddleia davidii</i>	Butterfly bush	DU	10 to 15		Y		Y				Sun	Under watch as potentially invasive along the East Coast; <i>Aesclepias tuberosa</i> is a preferred substitute to attract butterflies
<i>Buxus microphylla</i> var. <i>japonica</i>	Japanese boxwood	ES	3 to 6		Y	Y	Y		Y		Partial shade	More heat and nematode resistant than species.

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<i>Buxus microphylla</i> var. <i>koreana</i>	Korean boxwood	ES	3 to 4		Y	Y	Y				Sun to shade	*Foliage turns yellowish brown in winter; loose, open habit; cold tolerant.
<i>Buxus sempervirens</i> hybrids	'Green Mountain', 'Green Velvet'	ES	2 to 4		Y	Y	Y		Y		Partial shade	Supposedly do not discolor much in winter.
<i>Buxus sempervirens</i> 'Suffruticosa'	English boxwood	ES	2 to 5		Y	Y	Y		Y		Partial shade	* Can be kept very low (inches high) by pruning; slow-growing, dense; least susceptible to box leaf miner but is susceptible to nematodes.
<i>Callicarpa americana</i>	American beautyberry	DS	3 to 8		Y			Y	Y	Y	Sun, partial shade	Coarse, open habit, good for naturalizing.
<i>Callicarpa bodinieri</i>	Bodinier beautyberry	DS	6 to 10		Y				Y		Sun, partial shade	May be difficult to find in America.
<i>Callicarpa dichotoma</i>	Purple beautyberry	DS	3 to 4				Y		Y		Sun, partial shade	* Treat as herbaceous perennial. Dirr considers it the best of all <i>Callicarpa</i> .
<i>Callicarpa japonica</i>	Japanese beautyberry	DS	4 to 6 (10)		Y		Y		Y		Sun, partial shade	Bushy, rounded with arching branches.

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<i>Calluna vulgaris</i> 'Amethyst', etc.	Amethyst Scotch heather and other cultivars	ES	<1 to 2				Y				Sun, partial shade	Prefer acid, sandy, organic, moist, perfectly drained soils; do not over-fertilize; mulch and water during dry periods; good in rock gardens, edging, ground cover
<i>Calycanthus floridus</i>	Common sweetshrub, Carolina Allspice, Strawberry Shrub	DS	6 to 9		Y		Y	Y		Y	Sun to shade	Dense, bushy, rounded in cultivation; easily adaptable; trouble-free; not as tall in sun.
<i>Camellia japonica</i>	Japanese camellia	EU	10 to 15		Y	Y	Y				Partial shade	*Numerous cultivars. Cultivars may be more hardy.
<i>Camellia oleifera</i>	Tea-oil camellia	EU	10 to 12		Y	Y	Y				Sun, partial shade	*Cold-hardy to 10 degrees F and marginally hardy in Durham during colder winters. Cultivar: Fire 'N Ice (6' to 8')
<i>Camellia sasanqua</i>	Sasanqua camellia	ES	6 to 10		Y	Y	Y		Y		Sun, partial shade	*Numerous cultivars available. Blooms in fall. Less hardy than <i>C. japonica</i> .

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<i>Caryopteris x clandonensis</i>	Blue mist shrub, blue caryopteris	DS	2 to 3				Y		Y		Sun	Prefers loose, loamy soil; treat as herbaceous perennial.
<i>Castanea pumila</i>	Allegheny chinkapin	DS/ DU	6 to 10 (20 to 25)		Y			Y		Y	Sun to shade	Provides food for wildlife
<i>Cedrus deodara</i> 'Feelin' Blue'	Feelin' Blue Deodar cedar	ES	2	Y			Y				Sun	Spreading to 6 feet wide
<i>Cedrus deodara</i> (dwarf cultivars)	'Snow Sprite', 'Compacta', etc.	EU/ ET	10 to 20		Y	Y	Y		Y		Sun	Graceful, pendulous habit.
<i>Cephalanthus occidentalis</i>	Buttonbush	DS/DU	3 to 6 (10-15)		Y			Y		Y	Partial shade	Prefers wet conditions and will grow in water; will not tolerate dryness; looks dead until mid-May; naturalized, wet areas best.
<i>Chamaecyparis obtusa</i> 'Nana', 'Pygmaea Aurescens', 'Minima'	Dwarf Hinoki falsecypress, Compact Bronze Hinoki cypress	ES	1.5 to 2 (3)	Y	Y		Y				Sun	Very slow growing, mounded; border, rock gardens, specimen

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<i>Chimonanthus praecox</i>	Fragrant wintersweet	DU	10 to 15		Y	Y	Y				Sun, partial shade	Shrub borders; best along walks and entrances to buildings where fragrance can be appreciated; multi-stemmed shrub becoming leggy with age.
<i>Chionanthus virginicus</i>	Fringe tree	DU	20 to 25		Y	Y	Y	Y		Y	Sun, partial shade	Prefers moist, fertile, acid soil along stream banks; pollution tolerant; good in borders, groups, as accent or near large buildings.
<i>Clethra</i> spp.	Clethra, Pepperbush, Summersweet	ES	3 to 8		Y	Y	Y			Some	Sun to shade	*Prefers moist soil, tolerates wetness, and heavy shade, acidic soils.
<i>Cleyera</i> (see <i>Ternstroemia</i>)												
<i>Cornus amomum</i>	Silky dogwood	DS	6 to 10		Y			Y		Y	Sun, partial shade	Native to low woods, streams and swamps; becoming more straggly, unkempt with age; Scale may be a problem. Good for naturalizing in very wet areas.

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<i>Corylopsis glabrescens</i>	Fragrant winterhazel	DU	8 to 15			Y					Sun, partial shade	Spreading, dense, flat-topped, multi-stemmed; best against an evergreen background; need winter protection.
<i>Corylopsis spicata</i>	Spike winterhazel	DS	4 to 6 (8)			Y					Sun, partial shade	Twice as wide as high; early flowering.
<i>Corylus americana</i>	American filbert	DU	15 to 18 (8 to 10)					Y		Y	Partial shade, shade	Many diseases, none serious; should be limited in number because squirrels love the nuts.
<i>Cotoneaster adpressus</i>	Creeping cotoneaster	DS	1 to 1.5	Y			Y		Y		Sun, partial shade	Spreading to 4-6 feet. 'Little Gem' 'Tom Thumb' (see below) good cultivar.
<i>Cotoneaster apiculatus</i> 'Tom Thumb'	Tom Thumb cranberry cotoneaster	ES	1 to 2	Y			Y		Y		Sun	Spreading 5 feet; more susceptible to mites in dry situations; good on banks, slopes and rock gardens; also known as <i>C. adpressus</i> 'Tom Thumb'; best in colder climates.
<i>Cotoneaster dammeri</i>	Bearberry cotoneaster	ES	1 to 2	Y			Y		Y		Sun	*Spreading to 6 feet+; roots along stems.

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<i>Cotoneaster divaricatus</i>	Spreading cotoneaster	DS	5 to 6		Y		Y		Y		Sun	Spreading to 6-8 feet; multi-stemmed shrub.
<i>Cotoneaster horizontalis</i>	Rockspray cotoneaster	Semi-ES	2 to 3	Y			Y		Y		Sun	Spreading 5-8 feet; horizontal branching.
<i>Cotoneaster lacteus</i>	Parney's red clusterberry cotoneaster	ES	6 to 10		Y		Y		Y		Sun, partial shade	*Once established needs only occasional water.
<i>Cotoneaster microphyllus</i> var. <i>thymifolius</i>	Little-leaf or thyme rockspray cotoneaster	ES	2 to 3	Y			Y		Y		Sun, partial shade	Dwarf or prostrate. Good groundcover.
<i>Cotoneaster salicifolia</i>	Willowleaf cotoneaster	EU	10 to 15		Y	Y	Y		Y		Sun, partial shade	Spreading, arching habit; purplish tinge in winter.
<i>Daphne odora</i>	Winter daphne	ES	3 to 4		Y	Y	Y				Sun to shade	*May be marginally hardy in Durham; maintained areas and winter protection best
<i>Deutzia gracilis</i>	Slender deutzia	DS	3 to 6		Y	Y			Y		Sun, partial shade	* Easily rooted. Best in shrub borders.
<i>Deutzia scabra</i>	Fuzzy deutzia	DS	6 to 10		Y	Y					Sun, partial shade	* 'Pride of Rochester' popular old cultivar

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<i>Dirca palustris</i>	Leatherwood	DS	3 to 6		Y		Y			Y	Partial shade, shade	Thrives in moist, shady areas; prefers deep, organic soils; follows water courses naturally.
<i>Elaeagnus x ebbingii</i>	Elaeagnus	ES	8 to 10		Y	Y	Y		Y		Sun, partial shade	More vigorous than the species; has spines. Not currently on the watch list but may be added later.
<i>Enkianthus campanulatus</i>	Red-vein Enkianthus	DU	12 to 15 (15 to 30)		Y		Y				Sun, partial shade	*May be marginally hardy in Durham; cultivars and varieties: 'Red Bells', 'Albiflorus', 'Renoir', 'Showy Lantern'; good flower and fall color; needs acidic soils.
<i>Euonymus americanus</i>	Strawberry bush, "Hearts-A-Burstin"	DS	4 to 6		Y	Y	Y	Y	Y	Y	Partial shade	Loose, suckering shrub.
<i>Euonymus japonicus</i>	Japanese euonymus	EU	10 to 15		Y	Y			Y		Sun to shade	*Tolerates salt spray and Piedmont clays; susceptible to significant diseases.
<i>Euonymus japonica</i> 'Microphyllus'	Dwarf Japanese euonymus	ES	1 to 3	Y					Y		Sun to shade	*Smaller-leaved variety.

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<i>Euonymus kiautschovicus</i>	Spreading euonymus	Semi-ES	5 to 10		Y	Y	Y		Y		Sun, partial shade	*Not as susceptible to scale as other euonymus. Not good near patios, decks, etc. - draws flies in flower. Foliage usually "burns" in winter and looks unkempt.
<i>Euonymus kiautschovicus</i> 'Manhattan'	Manhattan euonymus	Semi-ES	4 to 6 (8)		Y	Y	Y		Y		Sun, partial shade	Many killed back in winter, but will re-grow rapidly in spring.
<i>Exochorda racemosa</i>	Pearlbush	DU	9 to 15		Y	Y			Y		Sun, partial shade	*Heat and drought tolerant; shrub border best; floppy and unkempt with age.
<i>Forsythia x intermedia</i>	Border forsythia	DS	8 to 10		Y	Y	Y		Y		Sun, partial shade	*Size varies with cultivars; valued for early spring flowers; arching stems root and sucker. Withstands city conditions. Many diseases, none troubling.
<i>Forsythia x intermedia</i> hybrids 'Beatrix Farrand', 'Lynwood Gold', 'Golden Times', 'Spring Glory', etc.	Hybrid forsythias	DS	Varies, mostly 8 to 10		Y	Y	Y		Y		Sun, partial shade	'Nana' is one of shortest at 5 feet

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<i>Fothergilla major</i>	Large fothergilla	DS	6 to 10		Y	Y	Y		Y		Partial shade	Leathery foliage; acid soils a must.
<i>Gardenia augusta</i> (<i>G. jasminoides</i>)	Gardenia	ES	4 to 6		Y	Y	Y		Y		Sun, partial shade	Marginally hardy in Durham.
<i>Hamamelis mollis</i>	Chinese witchhazel	DU	10 to 15		Y				Y		Sun, partial shade	Prefers acidic, moist, well-drained, organic soils. Least hardy <i>Hamamelis</i> .
<i>Hamamelis vernalis</i>	Vernal witchhazel	DS	6 to 10		Y				Y		Sun, partial shade	Multi-stemmed, dense, rounded; best in moist situations; pH adaptable.
<i>Hamamelis virginiana</i>	Common witchhazel	DU	20 to 30		Y			Y	Y	Y	Sun to shade	Naturalized areas, mass plantings, shrub borders in shady areas. Avoid extremely dry situations.
<i>Hamamelis x intermedia</i>	Witch hazel	DU	8 to 15 (15 - 20)		Y		Y				Sun to shade	*Many cultivars with red or yellow flowers, with similar fall colors.
<i>Hibiscus syriacus</i>	Rose of Sharon, Althea	DS/ DU	8 to 12				Y				Sun, partial shade	* Grows in any soils except those extremely wet or dry; prefers hot weather.

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<i>Hydrangea arborescens</i> 'Annabelle'	Annabelle hydrangea	DS	3 to 6		Y	Y	Y	Y			Sun, partial shade	*Suckers freely and will cover large area; prefers well-drained, moist soils; many diseases. Shrub borders best.
<i>Hydrangea macrophylla</i>	Bigleaf hydrangea	DS	3 to 6		Y		Y				Partial shade, shade	*Best for shrub borders.
<i>Hydrangea macrophylla</i> 'Pia'	Pia hydrangea	DS	2 to 3		Y		Y				Partial shade, shade	*
<i>Hydrangea paniculata</i>	Pee Gee hydrangea	DU	8 to 20		Y		Y				Sun, partial shade	*Extremely coarse texture, unattractive in late fall and winter; grows fast; shrub borders best, although doesn't blend well.
<i>Hydrangea quercifolia</i>	Oakleaf hydrangea	DS	4 to 8		Y		Y		Y	Y	Sun, partial shade	* Leaf blight may be a problem.
<i>Hypericum calycinum</i>	Aaronsbeard St. Johnswort	Semi-ES	1 to 1.5	Y		Y	Y		Y		Sun, partial shade	Spreading to 2'; good for dry, heavy soils.

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<i>Hypericum densiflorum</i>	Dense Hypericum	Semi-ES	4 to 6		Y	Y	Y		Y	Y	Sun, partial shade	Upright, oval; densely twiggy and leafy; flowers golden yellow, July to Sept.
<i>Hypericum frondosum</i>	Golden St. Johnswort	DS	3 to 4		Y	Y	Y		Y		Sun, partial shade	'Sunburst' lower and good edge plant.
<i>Hypericum patulum</i>	Goldencup St. Johnswort	Semi-ES	3		Y	Y	Y		Y		Sun, partial shade	Var. <i>henryi</i> more vigorous than species. 'Sungold' more hardy than 'Hidcote'.
<i>Hypericum prolificum</i>	Shrubby St. Johnswort	DS	1 to 4	Y					Y		Sun, partial shade	Small, dense bush with stiff, upright stems.
<i>Ilex aquifolium</i>	English holly	EU/ET	8 to 12 (30 to 80)		Y	Y					Sun, partial shade	*Need male and females for red berries; good hedges
<i>Ilex x aquipernyi</i>	Aquipern holly	EU/ET	9 to 12 (20 to 30)		Y		Y				Sun, partial shade	*Tall, showy shrub; 'Brilliant', 'San Jose' female clones. 'Aquipern' is a male clone.

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<i>Ilex 'Red Hollies'</i>	'Little Red', 'Robin', 'Festive', 'Cardinal', 'Oak Leaf', etc.	EU	10 to 15		Y	Y	Y		Y		Sun	New foliage usually reddish in color.
<i>Ilex cornuta 'Carissa'</i>	Carissa holly	ES	3 to 4		Y	Y	Y		Y		Sun, partial shade	*
<i>Ilex cornuta 'Needlepoint'</i>	Needlepoint holly	EU	10		Y	Y	Y		Y		Sun, partial shade	Upright shrub or small tree.
<i>Ilex cornuta 'Rotunda'</i>	Rotunda holly	ES	3 to 4		Y		Y		Y		Sun, partial shade	*
<i>Ilex crenata</i> cultivars: 'Helleri', 'Tiny Tim', 'Repandens', 'Carefree', 'Hoogendorn', etc	Dwarf Japanese hollies	ES	2 to 4	Y		Y	Y		Y		Sun, partial shade	*Many of these are slow growing and may eventually need pruning to maintain low height.
<i>Ilex crenata</i> cultivars: 'Hetzi', 'Rotundifolia', 'Soft Touch', 'Convexa', 'Microphylla'	Tall Japanese hollies	ES	4 to 10		Y	Y	Y		Y		Sun, partial shade	*
<i>Ilex decidua</i>	Possomhaw holly	DU	7 to 15 (30)		Y		Y	Y	Y	Y	Sun, partial shade	May be large shrub or small tree; more tolerant of alkaline soils than <i>I. verticillata</i> .

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<i>Ilex decidua</i> 'Warren's Red'	Warren's Red Possumhaw	DS/ DU	4 to 12		Y	Y	Y	Y	Y	Y	Sun, partial shade	One of last cultivars to lose its leaves.
<i>Ilex glabra</i> , <i>I. glabra</i> 'Nigra'	Inkberry holly, Nigra inkberry	ES	6 to 8		Y	Y	Y		Y	Y	Sun, partial shade	*Excellent foundation or naturalistic plantings. Spreads by underground stems (suckering); good for moist and wet areas; becomes leggy with age.
<i>Ilex glabra</i> 'Chamzin'	Nordic™ inkberry holly	ES	3 to 4		Y	Y	Y		Y	Y	Sun, partial shade	Compact; hardy; good hedge plant.
<i>Ilex glabra</i> 'Compacta'	Compact inkberry holly	ES	4 to 6		Y	Y	Y		Y	Y	Sun, partial shade	Slow-growing, good hedge plant, can easily be maintained at 2 feet or taller
<i>Ilex glabra</i> 'Densa'	Densa inkberry	ES	8 to 10		Y	Y	Y		Y	Y	Sun, partial shade	Thrives in moist soils, best in full sun, but tolerates shade; foundation, hedge, accent

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Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Ilex latifolia</i>	Lusterleaf holly	EU	8 to 12		Y		Y				Partial shade	**'Mary Nell' has heavy fruit; excellent specimen or hedge; needs well-drained soils.
<i>Ilex pernyi</i>	Perny holly	EU	9 to 12				Y		Y		Sun, partial shade	Upright habit, open outline.
<i>Ilex verticillata</i>	Common winterberry, black alder	DS	6 to 10				Y	Y		Y	Sun, partial shade	Native to swamps; will grow in water; suckering to form large, multi-stemmed clumps; best for shrub borders, water and wet soils.
<i>Ilex vomitoria</i>	Yaupon holly	EU	10 to 20		Y	Y	Y	Y	Y	Y	Sun to shade	Use for background or naturalizing; 'Pendula' weeping form.
<i>Ilex vomitoria</i> 'Nana'	Dwarf yaupon holly	ES	3 to 5		Y	Y	Y	Y	Y	Y	Sun, partial shade	*Spreading 8-10 ft wide over time.
<i>Ilex vomitoria</i> cultivars 'Stoke's Dwarf', 'Condeaux'	'Schelling's Dwarf' ('Stoke's Dwarf' (male)) Bordeaux™, etc. yaupon	ES	2 to 3	Y	Y	Y	Y	Y	Y	Y	Sun, partial shade	Good for border, some wider than tall

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<i>Ilex vomitoria</i> 'Shadow's Female'	Shadow's Female yaupon	EU	10 to 12		Y	Y	Y	Y	Y	Y	Sun	Richer, thicker foliage than most yaupons, good accent plant, can be topiary
<i>Illicium anisatum</i>	Japanese anise-tree	EU	8 to 12 (20)		Y	Y	Y				Partial shade	Best in moist, well-drained, acid soil. Often confused with <i>I. parviflorum</i> .
<i>Illicium parviflorum</i>	Hardy anise shrub	ES	7 to 14		Y	Y	Y				Sun, partial shade	*May be marginally hardy in Durham
<i>Itea virginica</i>	Virginia sweetspire	DS	3 to 5 (10)		Y	Y	Y	Y	Y	Y	Sun to shade	Prefers moist, fertile soils, wet places. More dense under cultivation.
<i>Juniperus chinensis</i> (dwarf cultivars)	Var. <i>procumbens nana</i> , 'Berkshire', 'Plumosa' 'Sea Green', 'Hetzii', etc.	ES	3 to 12				Y		Y		Sun	Sizes variable depending upon cultivar; all need full sun; subject to <i>Phomopsis</i> blight.
<i>Juniperus chinensis</i> var. <i>sargentii</i> and cultivars	Sargent's juniper	ES	1.5 to 2	Y			Y		Y		Sun	Needs full sun; subject to <i>Phomopsis</i> blight.

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<i>Juniperus chinensis</i> 'Pfitzeriana'	Pfitzer juniper	ES	5 to 10			Y	Y		Y		Sun	* Also some smaller cultivars such as 'Pfitzeriana Compacta' and 'Pfitzeriana Compacta Nicks'
<i>Juniperus conferta</i> cultivars	'Blue Pacific'*, 'Emerald Sea'*, 'Blue Lagoon', 'Boulevard', etc.	ES	1 to 2	Y			Y		Y		Sun	*Spreading 6 to 9 feet wide
<i>Juniperus davurica</i> 'Expansa' ('Parsoni')	Parsons juniper	ES	2 to 3	Y			Y		Y		Sun	*Spreads to 9 feet across, mounding.
<i>Juniperus horizontalis</i> cultivars	'Blue Vase', 'Blue Chip', 'Wiltonii' ('Blue Rug'), 'Plumosa'*, 'Compacta'*, 'Plumosa Compacta'*, 'Youngstown'*, etc.	ES	1 to 2	Y			Y		Y		Sun	*Spreading 4 to 8 feet wide
<i>Juniperus procumbens</i>	Japanese garden juniper	ES	0.5 to 2 (3)	Y			Y		Y		Sun	Spreads 10 to 15 feet (22 feet); 'Nana' is shorter; may be very susceptible to juniper blight, depending upon source.
<i>Juniperus sabina</i> cultivars	'Calgary Carpet' juniper	ES	3	Y			Y		Y		Sun	May be very susceptible to juniper blight depending upon source.

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<i>Juniperus squamata</i> 'Blue Star'	'Blue Star' juniper	ES	2 to 3	Y		Y	Y		Y		Sun	Susceptible to bagworms; slow-growing, grayish-green foliage color.
<i>Juniperus squamata</i> 'Holger'	Holger juniper	ES	6			Y	Y		Y		Sun	Susceptible to bagworms; flat-topped, spreading; new growth yellowish on blue-green older growth
<i>Juniperus virginiana</i> cultivars	'Blue Arrow', 'Blue Cloud', 'Grey Owl', etc.	EU/ET	Varies			Y	Y		Y	Y	Sun	Cedar apple rust and bagworms are problematic.
<i>Kalmia latifolia</i>	Mountain laurel	ES	4 to 8		Y		Y	Y	Y		Sun, partial shade	May be too warm here for this shrub; shady borders best, natural areas; toxic to livestock.
<i>Kerria japonica</i>	Japanese kerria	DS	3 to 6 (6 to 9)		Y						Partial shade, shade	Tough; best in borders, masses.
<i>Kolkwitzia amabilis</i>	Beautybush	DS	6 to 10 (15)				Y		Y		Sun	Difficult plant to find location for.
<i>Lagerstroemia indica</i> and hybrids	Crapemyrtles: 'New Orleans', 'Centennial', 'Chica', 'Tonto', 'Acoma', etc.	DU	5 to 15			Y	Y		Y		Sun	Mildew resistant hybrids best

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<i>Lavandula angustifolia</i>	Common lavender	ES	1 to 2	Y			Y		Y		Sun	Needs well-drained soil
<i>Lavandula x intermedia</i>	Hybrid lavender	ES	1 to 2	Y			Y		Y		Sun	Needs well-drained soil
<i>Lespedeza thunbergii</i>	Thunberg lespedeza	DS	4 to 8				Y		Y		Sun	Semi-woody and often killed back to ground in winter; accent plant
<i>Leucothoe axillaris</i>	Coastal leucothoe	ES	3 to 4				Y	Y			Shade	*Needs high moisture; may contract leaf spot.
<i>Leucothoe fontanesiana</i> (<i>catesbaei</i>)	Drooping leucothoe, dog hobble, fetterbush	ES	3 to 5				Y	Y		Y	Shade	Needs high moisture, subject to leaf spot.
<i>Leucothoe fontanesiana</i> 'Rainbow'	Rainbow drooping leucothoe	ES	3 to 5				Y	Y		Y	Shade	Slow grower, can be clipped to 18" tall to form low shady hedge; foliage poisonous.
<i>Leucothoe populifolia</i>	Florida leucothoe	EU	8 to 12								Shade	Needs high moisture, more resistant to leaf spot than others; seldom cultivated.
<i>Leucothoe racemosa</i>	Sweetbells leucothoe	DS	6 to 12					Y		Y	Shade	Leaf spot is a major problem for this species; tends to sucker; use sparingly.
<i>Ligustrum x vicaryi</i>	Golden vicary privet	EU	10 to 12			Y	Y		Y		Sun	Yellow foliage

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<i>Lindera benzoin</i>	Spice bush	DS	6 to 12		Y	Y	Y	Y	Y	Y	Sun, partial shade	Difficult to transplant; moist, well-drained soils best but tolerates dryness once established.
<i>Lindera obtusifolium</i>	Japanese spice bush	DU	15 to 20				Y		Y		Sun, partial shade	
<i>Lonicera nitida</i>	Boxleaf honeysuckle	ES (Semi)	6 to 8 (5-6)		Y	Y	Y		Y		Sun, partial shade	*
<i>Lonicera pileata</i>	Privet honeysuckle	ES (Semi)	2 to 3	Y			Y		Y		Sun, partial shade	
<i>Loropetalum chinense</i>	Loropetalum	ES	6 to 12		Y	Y	Y		Y		Sun, partial shade	* May be marginally hardy in Durham; withstands pruning
<i>Loropetalum chinense</i> var. <i>rubrum</i> 'Burgundy'	Burgundy loropetalum	EU	15 to 20		Y	Y	Y		Y		Sun, partial shade	*A JC Raulston Arboretum selection
<i>Loropetalum</i> hybrids	'Plum Delight', 'Ruby', 'Fire Dance', etc.	ES	4 to 10		Y	Y	Y		Y		Sun, partial shade	

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<i>Magnolia stellata</i>	Star magnolia	DU	10 to 20 (60)		Y	Y	Y				Sun	*Recommended cultivars: Royal Star, Waterlily, Centennial, Rosea.
<i>Magnolia virginiana</i>	Sweetbay magnolia	EU	10 to 15		Y	Y	Y				Sun, partial shade	*Native coastal plant, somewhat hardy in Durham. Tolerates wet soils.
<i>Mahonia aquifolium</i>	Oregon grape holly	ES	3 to 6 (9)				Y		Y		Partial shade, shade	*Protected locations best; many diseases.
<i>Mahonia fortunei</i>	Chinese mahonia	ES	5 to 6				Y		Y		Partial shade	Needs protection, marginally hardy.
<i>Mahonia repens</i>	Creeping mahonia	ES	<1 to 2	Y			Y		Y		Partial shade	Will need some shade in parking lots; spreading 3 to 4 feet; borders, small groupings, erosion control.
<i>Michelia figo</i>	Banana shrub	ES	6 to 10 (15)				Y		Y		Sun, Partial shade	Winter color is yellow-green; no significant pests; marginally hardy in Durham.
<i>Myrica cerifera</i>	Southern wax myrtle	EU	10 to 15 (20)		Y	Y	Y	Y	Y		Sun, partial shade	*Native to coast; deer tolerant; may be tree-form.

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<i>Myrica pensylvanica</i>	Northern bayberry	ES	5 to 12		Y	Y	Y		Y		Sun, partial shade	Suckers to form large colonies.
<i>Nandina domestica</i> cultivars ('Nana', 'Pygmaea', 'Fire Power', 'Compacta')	Dwarf nandina and Fire Power nandina	ES	1 to 2	Y			Y				Sun, partial shade	*Species under watch as invasive; cultivars with few or no berries are allowed
<i>Nandina domestica</i> 'Monfar'	Sienna Sunrise™ nandina	ES	3 to 4		Y	Y	Y				Sun, partial shade	Best in groupings for color effect in winter; berries rare.
<i>Osmanthus fragrans</i>	Fragrant tea olive	EU	10 to 20 (30)		Y		Y				Sun, partial shade	Marginally hardy here; winter protection needed.
<i>Osmanthus heterophyllus</i>	Holly osmanthus	EU	6 to 12 (20)		Y	Y	Y				Sun, partial shade	* Several cultivars available.
<i>Osmanthus x fortunei</i>	Osmanthus, Fortune's tea olive	EU	9 to 12		Y	Y	Y				Sun	*Preferred over <i>O. heterophyllus</i> by Dirr.
<i>Paxistima canbyi</i>	Canby paxistema	ES	1	Y			Y		Y		Sun, partial shade	Prefers calcareous soils, moist, well-drained.
<i>Perovskia atriplicifolia</i>	Russian sage	ES	3 to 5				Y		Y		Sun	Woody, herbaceous plant.

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<i>Philadelphus coronarius</i>	Sweet mock orange	DU	10 to 12				Y				Sun, partial shade	Leggy; moist, well-drained soils best.
<i>Photinia glabra</i>	Japanese photinia	EU	10 to 12				Y				Sun	*Smallest of photinias.
<i>Photinia serrulata</i>	Chinese photinia	ET	20 to 25 (30+)		Y	Y	Y		Y		Sun, partial shade	*Offensive odor in spring. May have some disease problems and affected by colder winters.
<i>Photinia x fraseri</i>	Fraser photinia	EU	10 to 15 (20)		Y	Y	Y		Y		Sun, partial shade	"Red tip" photinias, have been affected by colder winters, diseases.
<i>Physocarpus opulifolius</i>	Common (eastern) ninebark	DS	5 to 10				Y		Y		Sun, partial shade	Easily transplanted, adaptable; ragged in winter.
<i>Picea abies</i> (dwarf cultivars) 'Little Gem', 'Pendula', etc.	Dwarf Norway spruce	ET	Varies				Y		Y		Sun	Prefers colder climate but adaptable if sufficient moisture when planted.
<i>Picea glauca</i> (dwarf cultivars) 'Conica', etc.	Dwarf Alberta spruce	EU	Varies (10 to 12)				Y		Y		Sun	Very slow growing; best in moist loam or alluvial soils; some mite problems.
<i>Picea pungens</i> (dwarf cultivars) 'Globosa', 'Montgomery', etc.	Dwarf Colorado spruce	ET	Varies				Y		Y		Sun	Some pests; blue foliage, best in groupings; dry climates best.

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<i>Pieris japonica</i> cultivars ('Christmas Cheer', 'Mountain Fire')	Japanese pieris (andromeda)	ES	9 to 12		Y		Y				Partial shade, shade	*Needs some shelter from wind; good in shrub borders; slow growing.
<i>Pinus mugo</i> (dwarf cultivars) 'Compacta', 'Pumilio', 'Mughus'	Mugo pine, Swiss mountain pine	ES	Varies, usually <8				Y		Y		Sun	*Use grafted plants for true dwarf forms. Highly variable size and form even among the same cultivars.
<i>Pinus sylvestris</i> (dwarf cultivars) 'Nana', 'Hillside Creeper', etc.	Dwarf Scotch pine	EU/ET	Varies				Y		Y		Sun	May be marginally hardy here (too hot).
<i>Pinus thunbergii</i> (dwarf cultivars) 'Nana', 'Thunderhead'	Dwarf Japanese black pine	ET/EU	Varies				Y		Y		Sun	Tremendously salt tolerant.
<i>Potentilla fruticosa</i> and cultivars	Shrubby potentilla	DS	1 to 4	Y		Y	Y		Y	Y	Sun, partial shade	Shrubby borders, edges, mass plantings; spider mites can be a problem; should be pruned regularly.
<i>Prunus laurocerasus</i>	English laurel	EU	10 to 12(18)		Y		Y		Y		Sun, partial shade	*Many diseases affect the <i>Prunus</i> species.
<i>Prunus laurocerasus</i> cultivars	Dwarf English laurel	ES	3 to 4		Y	Y	Y		Y		Sun to shade	'Otto Luyken'* and 'Zabeliana'*

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<i>Punica granatum</i>	Pomegranate	DU	12 to 20		Y		Y		Y		Sun, partial shade	Large shrub to small tree; good in borders, groups; not good in hedges
<i>Pyracantha coccinea</i> hybrids	'Mohave', 'Navaho', 'Red Elf', 'Tiny Tim', etc.	EU/ET	Varies				Y		Y		Sun	Thorns; more resistant to scab and fireblight than species.
<i>Pyracantha koidzumii</i> 'Low-Dense'	Low-dense pyracantha	E to semi-ES	4 to 6				Y		Y		Sun	*Good for hot, dry areas; mounded habit.
<i>Raphiolepis x delacourii</i>	Indian hawthorn	ES	3 to 4		Y	Y	Y		Y		Sun, partial shade	*Marginally hardy in Durham. More resistant to leaf spot.
<i>Raphiolepis x delacourii</i> 'Georgia Petite'®	'Georgia Petite' Indian hawthorn	ES	2.5	Y		Y	Y		Y		Sun, partial shade	Low, mounding habit; tolerates salt; resistant to leaf spot.
<i>Raphiolepis umbellata</i>	Yeddo hawthorn	ES	4 to 6		Y	Y	Y				Sun	*Marginally hardy in Durham; salt tolerant; leaf spot in moist locations; winter protection needed.
<i>Rhododendron austrinum</i>	Florida azalea	DS	8 to 10		Y		Y		Y		Partial shade	Loose, multi-stemmed shrub;

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<i>Rhododendron calendulaceum</i>	Flame azalea	DS	4 to 8		Y		Y	Y	Y		Partial shade	*Native to western NC, marginally hardy in Durham; excellent for naturalizing; late flowering.
<i>Rhododendron catawbiense</i>	Catawba rhododendron	ES	6 to 8		Y		Y	Y		Y?	Partial shade	*Often becomes leggy in unfavorable locations. May be marginally hardy here (too hot).
<i>Rhododendron eriocarpum</i>	Dwarf indica azalea (Gumpo)	ES	1 to 2				Y				Partial shade	*Good border plant.
<i>Rhododendron hybrida</i>	Satsuki azalea	ES	2 to 4				Y				Partial shade	*
<i>Rhododendron hybrida</i>	Glenn Dale azalea	ES	4 to 6		Y		Y				Partial shade	*Cold tolerant; many cultivars and colors.
<i>Rhododendron hybrida</i>	'Knap Hill' & 'Exbury Hybrid' hybrid azaleas	DS	6 to 8		Y		Y				Partial shade	*Excellent for naturalizing; resemble Flame azaleas.
<i>Rhododendron indica</i>	Southern Indica azalea hybrids	ES	6 to 12				Y				Sun to shade	*Marginally hardy in Durham, killed during colder winters.
<i>Rhododendron kaempferi</i>	Kaempferi azalea hybrids	Semi-ES to DS	4 to 10		Y		Y				Sun, partial shade	*Easier, less demanding than Kurume azaleas; reddish purple foliage in winter.

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<i>Rhododendron maximum</i>	Rosebay rhododendron	EU to ET	4 to 30					Y		Y	Partial shade, shade	Requires cool, moist, well-drained soils; not suited to normal landscape situations.
<i>Rhododendron obtusum</i>	Kurume or Hiryu azalea	ES	2 to 4		Y	Y	Y				Partial shade	Dense plants. Many cultivars also: 'Hino-Crimson', 'Hinodegiri', 'Hershey's Red', etc.
<i>Rhododendron periclymenoides</i>	Pinxterbloom azalea	DS	5 to 8		Y		Y	Y		Y	Partial shade	*Size varies with habitat; fragrant, pale-pink flowers in late spring.
<i>Rhododendron</i> 'P.J.M.' Hybrids	P.J.M. Hybrid azaleas	ES	3 to 6		Y	Y	Y			Y	Partial shade	Good for foundation, low hedge; tolerates heat.
<i>Rhododendron prinophyllum</i> (roseum)	Roseshell azalea	DS	2 to 8		Y		Y				Partial shade	Very hardy and tolerant of high pH; numerous spreading branches.
<i>Rhododendron prunifolium</i>	Plumleaf azalea	DS	8 to 10 (15)				Y				Partial shade	*Cultivars: 'Cherry-Bomb', 'Coral Glow', 'Lewis Short', 'Peach Glow'
<i>Rhododendron vaseyi</i>	Pinkshell azalea	DS	5 to 10		Y	Y	Y		?		Partial shade	Native to NC mountains; irregular, upright habit.
<i>Rhododendron viscosum</i>	Swamp azalea	DS	1 to 8 (ave. 5)		Y		Y			Y	Partial shade	Native to swamps, beside ponds.

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Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Rhodotypos scandens</i>	Black jetbead	DS	3 to 6		Y				Y		Sun, partial shade	*Mounded, arching branches, often shabby.
<i>Rhus aromatica</i>	Fragrant sumac	DS	2 to 6 (varies)				Y?		Y	Y	Sun, partial shade	Fast cover for banks, etc.; develops roots where stems touch soil; use with discretion.
<i>Rhus aromatica</i> 'Gro-Low'	Gro-low fragrant sumac	DS	2 to 3	Y					Y	Y	Sun, partial shade	Spreads 6 to 8 feet; use with discretion.
<i>Rhus copallina</i>	Flameleaf (shining) sumac	DU	20 to 30					Y	Y		Sun, partial shade	Use with discretion since it tends to form large colonies.
<i>Rhus glabra</i>	Smooth sumac	DU	10 to 15		Y			Y	Y	Y	Sun	Suckering to form colonies; use with discretion.
<i>Rosa carolina</i>	Pasture rose, Carolina rose	DS	3 to 6					Y	Y		Sun to shade	Freely-suckering shrub to form dense thickets; use with restraint.
<i>Rosa rugosa</i>	Rugosa rose	DS	4 to 6		Y	Y	Y		Y		Sun	*Many diseases; tolerates salt.

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Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Rosmarinus officinalis</i>	Rosemary	ES	2 to 4 (6 to 7)	Y	Y	Y	Y		Y		Sun	Salt tolerant; any soil except those permanently wet; can be maintained below 30" tall.
<i>Sambucus canadensis</i>	Common elderberry	DS	5 to 12 (varies)					Y		Y	Sun	Prefers moist sites; suckers profusely.
<i>Santolina chamaecyparissus</i>	Santolina; lavender cotton	ES	1 to 2	Y			Y		Y		Sun	Mounding, slow-growing, sub-shrub; adaptable; prefers low fertility.
<i>Sarcococca hookeriana humilis</i>	Himalayan sarcococca	ES	1.5 to 2				Y		Y		Partial shade	Suckers to form large colonies; pollution tolerant; spreads to 8 feet; tall ground cover for shady spots.
<i>Sarcococca ruscifolia</i>	Fragrant sarcococca	ES	3 to 5		Y	Y	Y		Y		Partial shade	Slow grower; good for shady spots.
<i>Skimmia japonica</i>	Japanese skimmia	ES	2 to 5		Y		Y				Partial shade, shade	*Need both male and female plants for fruit; needs to be moist but not soggy.
<i>Skimmia reevesiana</i>	Reeves skimmia	ES	1.5 to 2				Y				Partial shade, shade	Both sexes on same plant; slow growing, needs to be moist, acidic, but not soggy.

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				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Spiraea cantoniensis</i> 'Lanceata'	Double Reeves spirea	DS	4 to 6		Y	Y	Y		Y		Sun, partial shade	*Heat tolerant; prune after flowering in spring; fast grower. Prefers regular watering.
<i>Spiraea nipponica</i> 'Snowmound'	Snowmound spirea	DS	3 to 5		Y	Y	Y		Y		Sun, partial shade	*Prefers regular watering.
<i>Spiraea thunbergii</i>	Thunberg spirea	DS	3 to 5		Y	Y	Y		Y		Sun, partial shade	*Needs pruning after flowering for best shape; loose-spreading, twiggy.
<i>Spiraea x bumalda</i> cultivars 'Crispa', 'Gold Flame', 'Norman', 'Nywoods', Little Princess', 'Gold Mound'	Bumalda spirea	DS	2 to 3	Y		Y	Y		Y		Sun, partial shade	Prefers full sun, open areas. 'Crispa', 'Gold Flame', 'Norman', 'Nywoods' cultivars all under 3' tall.
<i>Spiraea x bumalda</i> cultivars 'Anthony Waterer', 'Monhub'	Anthony Waterer spirea, Limemound® spirea	DS	3 to 5		Y	Y	Y		Y		Sun, partial shade	
<i>Spiraea x vanhouttei</i>	Vanhoutte spirea	DS	6 to 8		Y	Y	Y		Y		Sun, partial shade	*Very hardy; arching branches. 'Renaissance' more disease resistant, prefers full sun.

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Table 2, Recommended Shrubs

Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Stewartia ovata</i>	Mountain stewartia	DU	10 to 15		Y		Y	Y		Y	Partial shade	Needs some shade here during hottest periods; should be planted when small; acid soils best.
<i>Styrax grandifolius</i>	Bigleaf snowbell	DU	8 to 12 (15)					Y			Partial shade, shade	Naturalized along stream banks
<i>Syringa x persica</i>	Persian lilac	DS	4 to 8				Y				Sun, partial shade	* May be more hardy than common lilac in Durham
<i>Taxus chinensis</i>	Chinese yew	ES	5 to 10						Y		Sun, partial shade	
<i>Taxus cuspidata</i>	Japanese yew	ES/ EU	4 to 6 (10 to 40)		Y		Y		Y		Partial shade, shade	*Tolerates urban conditions; variable form; poisonous; some cultivars ('Aurescens', 'Cross Spreading') low growing.
<i>Taxus tuberosa</i> 'Monloo' TM	Emerald Spreader [®] Japanese yew	ES	2.5	Y		Y	Y		Y		Sun, partial shade	Slow-spreading to 8 to 10 feet wide; good on embankments, as low hedge; poisonous.

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				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Ternstroemia gymnanthera</i>	Cleyera, Japanese ternstroemia	ES	8 to 10		Y		Y				Partial shade	*Salt tolerant, may be marginally hardy in Durham; often sold as <i>Cleyera japonica</i> . Good in protected situations.
<i>Ternstroemia gymnanthera</i> 'Contherann'	Le Ann™ Ternstroemia;	EU	10 to 12		Y		Y				Partial shade, shade	Good sound attenuation plant if grown as hedge; more hardy than species.
<i>Ternstroemia gymnanthera</i> 'Conthery', 'Phyllis Ann'	Bronze Beauty™ Ternstroemia, Phyllis Ann Ternstroemia	ES	6 to 8		Y	Y	Y				Sun, partial shade	Both are good as screen, patio plant, or specimen; more hardy than species.
<i>Teucrium chamaedrys</i>	Wall germander	ES	1 to 1.5	Y			Y		Y		Sun	Mounding evergreen sub-shrub; low hedge or edging plant; good for rock gardens.
<i>Thuja occidentalis</i> 'Hetz Midget'	Hetz Midget arborvitae	ES	3 to 4		Y		Y				Sun, partial shade	Slow growing; rounded; many diseases and pest, none serious; good in mixed borders, containers; often brown in winter; prefers moist air and soil.
<i>Vaccinium arboreum</i>	Sparkleberry; farkleberry	DU	15 to 20					Y	Y		Partial shade, shade	Naturalized in rather dry woods

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Scientific Name	Common Name	Plant Type (See Note 1)	Height (Feet)	Use Category (See Section 5A.)					Drought Tolerant (See Note 2)	Native to Durham**	Exposure	Notes
				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Vaccinium corymbosum</i>	Highbush blueberry	DS/DU	6 to 12		Y	Y		Y		Y	Sun, partial shade	Native to swampy soils, likes acidic, sandy soils.
<i>Viburnum acerifolium</i>	Maple-leaf viburnum	DS	4 to 6		Y			Y	Y	Y	Partial shade, shade	Low, sparse shrub reserved for naturalizing.
<i>Viburnum awabuki</i> 'Chindo'	Chindo sweet viburnum	EU	10 to 12 (15)		Y	Y	Y		Y		Sun, partial shade	*Moisture tolerant; great for hedges; a JC Raulston Arboretum selection; fast grower to 8' wide.
<i>Viburnum bracteatum</i> 'Emerald Luster'	Emerald luster viburnum	DU	10 to 12		Y		Y		Y		Sun, partial shade	Open, multi-branched; wide as tall; good background plant for border; year-round interest.
<i>Viburnum carlesii</i>	Koreanspice viburnum	DS	4 to 5 (8)		Y	Y	Y		Y		Sun, partial shade	Very fragrant; plant in shrub borders, behind perennials, foundation planting.
<i>Viburnum davidii</i>	David viburnum	ES	2 to 3	Y	Y	Y	Y		Y		Sun to shade	Low-mounding; acid-loving; good in borders, as foundation planting.

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				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Viburnum dentatum</i> 'Christom'	Blue Muffin™ arrowwood viburnum	DS	5 to 6		Y	Y	Y	Y	Y?	Y?	Sun to shade	Slow-growing; good low hedge, back of border, woodland or natural areas. More compact than species; resilient and care-free.
<i>Viburnum dentatum</i> 'Morton', 'Synnesvedt'	Northern Burgundy™ viburnum; Chicago Luster® viburnum	DU	10 to 12		Y	Y	Y	Y	Y?	Y?	Sun to shade	Excellent for borders, screens and mass plantings.
<i>Viburnum lantana</i> 'Mohican'	Mohican viburnum	DS	6 to 8		Y	Y	Y		Y		Sun	Coarse winter shape; good hedge, deciduous screen, massing, shrub border; more compact than species and more disease resistant.
<i>Viburnum lentago</i>	Nannyberry viburnum, sheepberry	DU	12 to 18 (30)		Y		Y		Y	Y	Sun to shade	Spread 6' to 10'; some mildew problems in shade; suckers to form thickets; good for naturalizing, shrub borders, as screen or background; use with discretion.
<i>Viburnum nudum</i> cultivars 'Earth Shade', 'Winterthur'	Smooth viburnum cultivars	DU	10 to 15		Y	Y	Y	Y	Y		Sun, partial shade	'Winterthur' more compact, narrower; both good for shrub borders, screens, mass plantings.

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				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Viburnum obovatum</i> 'Densa'	Dwarf Walter's viburnum	DS to Semi-ES	4 to 5		Y	Y	Y		Y		Sun, partial shade	Half the size of species; compact; good hedge.
<i>Viburnum odoratissimum</i> 'Red Tip'	Red Tip viburnum	EU	10 to 15		Y	Y	Y		Y		Sun, partial shade	Fast, vigorous growth; good hedge, background plant.
<i>Viburnum opulus</i> 'Compactum'	Compact cranberrybush viburnum	DS	4 to 5		Y	Y	Y		Y		Sun, partial shade	Beautiful specimen or use in informal hedge, border, foundation plant; good for wildlife.
<i>Viburnum opulus</i> 'Nanum'	Dwarf cranberrybush viburnum	DS	2 to 2.5	Y		Y	Y		Y		Sun, partial shade	Dense, mounding; good low hedge, filler plant.
<i>Viburnum opulus</i> 'Sterile'	Eastern snowball	DU	12		Y		Y		Y		Sun, partial shade	Specimen, hedge or border, windbreak; deer resistant.
<i>Viburnum plicatum</i> var. <i>tomentosum</i>	Doublefile viburnum	DU	8 to 20		Y		Y				Sun, partial shade	*Excellent specimen, hedge, border.

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<i>Viburnum plicatum</i> var. <i>tomentosum</i> cultivars 'Mariesii', 'Pink Beauty', 'Shasta', 'Shoshoni', 'Summer Snowflake'	Doublefile viburnum cultivars	DS	Varies, 5 to 8		Y	Y	Y				Sun, partial shade	Smaller than species; all make good hedges, specimens, borders, foundation plantings; deer resistant.
<i>Viburnum prunifolium</i>	Blackhaw viburnum, blackhaw stagbrush	DU	12 to 15		Y			Y	Y		Sun to shade	Excellent tall screen, hedge or background plant; songbird food source.
<i>Viburnum rhytidophyllum</i>	Leatherleaf viburnum	EU	10 to 15		Y		Y				Shade	*Protect from wind, winter sun; coarse in all seasons; massing or background plant.
<i>Viburnum rufidulum</i>	Rusty blackhaw viburnum	DU/DT	10 to 20 (30 to 40)				Y	Y	Y		Sun to shade	More dense in full sun, more open in shade.
<i>Viburnum tinus</i>	Laurustinus	ES	6 to 12		Y		Y		Y		Sun, partial shade	Good screen, hedge; insect and disease free; salt tolerant; 'Variegata' clone.

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				Parking Lots	Suburban Buffers/Natural	Urban Screens/ Buffers	Accent/Other	Riparian Buffers				
<i>Viburnum x burkwoodii</i>	Burkwood viburnum	DS	6 to 12		Y		Y		Y		Sun, partial shade	* 'Mohawk' is disease resistant; somewhat straggly with age; tolerates pollution; hedge, screen or accent.
<i>Viburnum x pragense</i>	Pragense viburnum	ES	8 to 10		Y		Y		Y		Sun, partial shade	Similar to <i>V. rhytidophyllum</i> .
<i>Viburnum x rhytidophylloides</i>	Lantanaphyllum viburnum	DS	8 to 10 (15)		Y		Y		Y		Sun, partial shade	Screen, foundation plant, blended with other broadleaf evergreens; needs other viburnums for fruit set. 'Alleghany' good cultivar.
<i>Vitex agnus castus</i>	Chastetree	DU	15 to 20		Y	Y			Y		Sun	* 'Alba' (white), 'Rosea' (pink)
<i>Vitex negundo</i>	Chastetree	DU	10 to 15		Y	Y			Y		Sun	
<i>Weigela florida</i>	Weigela	DS	6 to 9		Y	Y					Sun	*Spreading, dense rounded; coarse; best in shrub borders, grouping or massing
<i>Weigela florida</i> 'Variegata Nana'	Dwarf variegated weigela	DS	3	Y		Y					Sun	Most dwarf of weigelas; some specimens larger.

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<i>Xanthorhiza simplicissima</i>	Yellowroot	DS	2 to 3	Y				Y	Y		Sun, partial shade	Freely suckering, spreading, flat-topped ground cover for difficult sites; less invasive in dry soils; prefers moist stream banks.
<i>Yucca filamentosa</i>	Adam's needle yucca	ES	2 to 2.5	Y			Y		Y		Sun	Sharp, long, upright, spreading leaves.
<i>Yucca flaccida</i>	Weakleaf yucca	ES	1 to 2	Y			Y		Y	Y	Sun	Differs from <i>Y. filamentosa</i> by bend in leaves, thread-like fibers.
<i>Yucca gloriosa</i>	Spanish dagger yucca	ES	6 to 8				Y		Y		Sun	*May be somewhat marginal in this area; spine-tipped leaves
<i>Zenobia pulverulenta</i>	Dusty zenobia	Semi-ES /DS	2 to 3 (6)				Y	Y		Y	Sun to shade	Requires acid, moist, well-drained soil.

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Table 3, Trees Not Recommended

Latin Name, Common name	Where Not Recommended /No Credit Given	Native or Exotic	Reasons for Concern
<i>Acer rubrum</i> , 'Armstrong' Armstrong columnar red maple	All uses	Native	Weak-wooded and prone to storm damage
<i>Acer saccharinum</i> , Silver maple	All uses	Exotic	Weak-wooded and prone to storm damage, very vigorous roots and disease-prone
<i>Acer platanoides</i> Norway maple	All uses	Exotic	Invasive tendencies
<i>Ailanthus altissima</i> , Tree of Heaven	All uses	Exotic	Weak-wooded and prone to storm damage
<i>Broussonetia papyrifera</i> Paper mulberry	All uses	Exotic	Invasive tendencies
<i>Celtis occidentalis</i> , Common Hackberry	All uses	Exotic	Weak-wooded and prone to storm damage
<i>Cinnamomum camphora</i> Camphortree	All uses	Exotic	Invasive tendencies
<i>Cornus florida</i> , Dogwood	Street trees and parking lots	Native	Generally does not do well in full sun or hot areas; should be planted at the edge of a canopy of trees or the north side of a building that provides shade; subject to Anthracnose
<i>Craetagus spp.</i> , Hawthorns	All uses	Exotic	Many insect and disease problems; generally don't fare well in the South
<i>Fraxinus americana</i> , White ash	All uses	Native	Many disease and insect problems
<i>Ginkgo biloba</i> , Ginkgo (species) (Some cultivars OK)	All uses	Exotic	Has a haggard appearance for the first 15-25 years until it develops a full crown; some cultivars better
<i>Juglans nigra</i> , Black Walnut	All uses, except possibly a single specimen on a very large lot	Native	Although a handsome tree, does not allow anything else to grow under or around it (allelopathic)
<i>Liquidambar styraciflua</i> , Sweetgum (species)	Street trees and parking lots	Native	Not a specimen tree; fruit is generally a nuisance around buildings and over streets and parking lots
<i>Malus spp.</i> , Apples and Crabapples, (Some cultivars better - see recommended list)	All uses	Exotic	Many insect and disease problems; excessive suckering is unattractive; fruit may be a nuisance around buildings and over streets and parking lots; see "Recommended Trees" list for exceptions in urban settings
<i>Morus spp.</i> & <i>Pyrus spp.</i> , Fruit trees (Mulberries, pears, etc.)	All uses	Exotic	Excessive suckering is unattractive; fruit may be a nuisance in parking lots, streets and around buildings, some may be weak-wooded (<i>Pyrus calleryana</i> 'Bradford' and similar trees are an example); <i>Morus papyrifera</i> , <i>Morus alba</i> and <i>Pyrus calleryana</i> have invasive tendencies

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Latin Name, Common name	Where Not Recommended /No Credit Given	Native or Exotic	Reasons for Concern
<i>Pinus echinata</i> , Shortleaf pine	Street trees and parking lots	Native	Shallow-rooted; prone to windthrow, storm damage and Southern Pine Beetle
<i>Pinus palustris</i> , Longleaf pine	All uses	Exotic	Native to NC coastal plain, but not piedmont; requires very sandy soil to grow
<i>Pinus strobus</i> , Eastern white pine	All uses	Exotic	Native to NC mountains but not piedmont; frequently dies suddenly in "hot spells" when 15-20 years old
<i>Platanus occidentalis</i> , Sycamore	All uses	Native	Large leaves and fruit may be considered a nuisance around buildings, over streets and parking lots; sycamore leaf scorch and anthracnose are becoming significant problems which are difficult to impossible to treat
<i>Populus alba</i> , White mulberry	All uses	Exotic	Invasive tendencies
<i>Populus balsamifera</i> ssp. <i>Balsamifera</i> Balsam poplar or balm of Gilead	All uses	Exotic	Invasive tendencies
<i>Prunus</i> spp., Cherries and plums	All uses	Exotic	Short-lived; seems to be too hot for them here; many insect and disease problems; see recommended list for exceptions
<i>Quercus acutissima</i> Sawtooth oak	All uses	Exotic	Invasive tendencies
<i>Quercus nigra</i> , Water oak	Street trees and parking lots	Native	Problems with untreatable decay
<i>Quercus palustris</i> , Pin or Swamp oak	Parking lots or street trees	Exotic	Iron chlorosis and bacterial scorch are common and difficult to treat; persistent branches (may be limbed up) and leaves
<i>Quercus virginiana</i> , Live oak	All uses	Exotic	Native to NC coastal plain, but not piedmont; too cold at times in winter to do well here
<i>Robinia pseudoacacia</i> , Black locust	All uses except repopulating disturbed stream buffers	Exotic	Not a specimen tree, prone to disease and decay; use along stream buffers should be limited to a minority of plantings as well, or it can take over
<i>Tilia cordata</i> cultivars (e.g. 'Greenspire'), Greenspire linden	All uses	Exotic	Littleleaf linden cultivars are not hardy here and develop problems with Botryospheria canker, which can't be treated; <i>Tilia cordata</i> is a better choice
<i>Tsuga canadensis</i> , Eastern hemlock	All uses	Exotic	Too hot for them here
<i>Ulmus</i> spp., Elms	All uses	Exotic	Many disease and insect problems, including Dutch Elm Disease; <i>Ulmus parvifolia</i> is an exception

Table 3, Trees Not Recommended

Latin Name, Common name	Where Not Recommended /No Credit Given	Native or Exotic	Reasons for Concern
Notes: From City of Durham, General Services Department, Urban Forestry Division and from "Invasive exotic plants to avoid in the southeastern United States", compiled for the North Carolina Botanical Garden by Allison Schwartz and Johnny Randall, Spring, 1999			

Table 4, Plants Not Recommended

Scientific Name	Common Name	Reasons for Concern
<i>Ajuga reptans</i>	Bugleweed, common bugle	Invasive tendencies
<i>Akebia quinata</i>	Chocolate vine, fiveleaf akebia	Invasive tendencies
<i>Alliaria officianalis</i> , <i>A. petiolata</i>	Garlic mustard	Invasive tendencies
<i>Allium vineale</i>	Wild garlic, field or crow garlic	Invasive tendencies
<i>Alnus serrulata</i>	Common alder	May colonize moist areas to the detriment of other plants
<i>Ampelopsis heterophylla</i>	Amur peppervine, porcelain-berry	Invasive tendencies; (see <i>A. brevipedunculata</i> on prohibited list)
<i>Arrhenatherum elatius</i>	Alligatorweed	Invasive tendencies
<i>Artemisia vulgaris</i>	Common wormwood, mugwort	Invasive tendencies
<i>Berberis thunbergii</i> and cultivars	Japanese barberry	Invasive tendencies
<i>Buxus microphylla</i> 'Compacta'	Littleleaf boxwood	Many diseases
<i>Buxus sempervirens</i> 'Arborescens'	Tree boxwood	Too hot here for this plant
<i>Cardiospermum halicacabum</i>	Balloon vine, love in a puff	Invasive tendencies
<i>Carduus vulgaris</i> (see <i>Cirsium vulgare</i>)		Invasive tendencies
<i>Carex kobomugi</i>	Japanese or Asiatic sand sedge	Invasive tendencies
<i>Cassia obtusifolia</i> (see <i>Senna obtusifolia</i>)		Invasive tendencies
<i>Ceanothus americanus</i>	New Jersey Tea	Doesn't do well in humid conditions or in heavy soils; difficult to transplant
<i>Chaenomeles japonica</i>	Japanese flowering quince	Ratty, thorny; leaf spots and abundant spring and early summer rainfall result in premature defoliation
<i>Chrysanthemum leucanthemum</i> (see <i>Leucanthemum vulgare</i>)		Invasive tendencies
<i>Centaurea biebersteinii</i>	Spotted knapweed	Invasive tendencies
<i>Clematis terniflora</i>	Leatherleaf clematis, sweet autumn virgin's bower	Invasive tendencies
<i>Commelina communis</i>	Common dayflower	Invasive tendencies
<i>Comptonia peregrina</i>	Sweet fern	Too hot here
<i>Cornus sericea</i> ; <i>C. stolonifera</i> and 'Flaviramea'	Redosier dogwood, yellow-twig dogwood	Freely spreading by underground stems, many diseases; considered potentially invasive
<i>Coronilla varia</i>	Crown vetch	Invasive tendencies

Table 4, Plants Not Recommended

Scientific Name	Common Name	Reasons for Concern
<i>Cotoneaster apiculatus</i>	Cranberry cotoneaster	Prefers colder climates; 'Tom Thumb' allowed -- apparently better here
<i>Cytisus scoparius</i>	Scotch broom	Short-lived; many diseases
<i>Diervilla sessilifolia</i>	Southern bush-honeysuckle	Native honeysuckle that suckers to form colonies and may take over
<i>Dipsacus fullonum</i> ; <i>D. fullonum sylvestris</i> ; <i>D. laciniatus</i> ; <i>D. sylvestris</i>	Fuller's teasel; common or wild teasel; cutleaf teasel	Invasive tendencies
<i>Egeria densa</i>	Brazilian waterweed, elodea	Invasive tendencies
<i>Eleutherococcus pentaphyllus</i>	Ginseng shrub, five-leaf aralia	Invasive tendencies
<i>Elodea densa</i> (see <i>Egeria densa</i>)		Invasive tendencies
<i>Eragrostis curvula</i>	Weeping lovegrass	Invasive tendencies
<i>Euphorbia esula</i>	Leafy spurge, wolf's milk	Invasive tendencies
<i>Foeniculum vulgare</i>	Sweet fennel	Invasive tendencies
<i>Fothergilla gardenia</i>	Dwarf fothergilla	Prefers coastal plain soils
<i>Gardenia jasminoides</i> and cultivars	Gardenias	Marginally hardy here; prefer warmer weather
<i>Glechoma hederacea</i>	Groundivy	Invasive tendencies
<i>Hedera helix</i>	English ivy	Invasive tendencies; allowed for use in the Urban, Compact and Downtown Tiers for screening purposes
<i>Hesperis matronalis</i>	Dames rocket	Invasive tendencies
<i>Hydrilla verticillata</i>	Waterthyme	Invasive tendencies
<i>Ilex opaca</i>	American holly	Native holly is not recommended due to the number of diseases
<i>Imperata cylindrical</i> , <i>I. arundinaceae</i>	Cogongrass	Invasive tendencies
<i>Ipomoea coccinea</i> ; <i>I. hederacea</i> ; <i>I. purpurea</i>	Red or redstar, ivyleaf and common or tall morning glory	Invasive tendencies
<i>Iris pseudacorus</i>	Yellow flag or pale yellow iris	Invasive tendencies
<i>Jasminum nudiflorum</i>	Winter jasmine	So adaptable it approaches weed status; roots from trailing branches and can take over large areas with time; allowed in Urban, Compact Neighborhood and Downtown Tiers for screening purposes
<i>Lapsana communis</i>	Common nipplewort	Invasive tendencies
<i>Ligustrum obtusifolium</i>	Border or blunt-leaved privet	Invasive tendencies
<i>Lonicera standishii</i>	Standish's honeysuckle	Invasive tendencies

Table 4, Plants Not Recommended

Scientific Name	Common Name	Reasons for Concern
<i>Lotus corniculatus</i>	Birdsfoot deervetch or birdsfoot trefoil	Invasive tendencies
<i>Ludwigia uruguayensis</i>	Primrosewillow or hairy water-primrose	Invasive tendencies
<i>Lyonia ligustrina</i> ; <i>L. lucida</i>	Northern maleberry; shining fetterbush	Arching suckers; weak growth; leaf spot; intolerant of stress
<i>Lysimachia nummularia</i>	Moneywort or creeping Jenny	Invasive tendencies
<i>Lytrum salicaria</i> ; <i>L. virgatum</i>	Purple loosestrife; European wand loosestrife	Invasive tendencies - very invasive in New England
<i>Mahonia bealei</i>	Oregon holly-grape	Invasive tendencies
<i>Melilotus alba</i>	White sweet clover	Invasive tendencies
<i>Mosla dianthera</i>	Miniature beefsteak	Invasive tendencies
<i>Murdannia keisak</i>	Asian spiderwort or aneilima	Invasive tendencies
<i>Myriophyllum aquaticum</i> ; <i>M. spicatum</i>	Parrotfeather watermilfoil; European or spike watermilfoil	Invasive tendencies
<i>Nasturtium officinale</i> (see <i>Rorippa nasturtium officinale</i>)		Invasive tendencies
<i>Panicum repens</i>	Torpedo grass	Invasive tendencies
<i>Paspalum urvillei</i>	Vasey's grass	Invasive tendencies
<i>Pastinaca sativa</i>	Wild parsnip	Invasive tendencies
<i>Perilla frutescens</i>	Beefsteak plant	Invasive tendencies
<i>Phalaris arundinacea</i>	Reed canarygrass	Invasive tendencies
<i>Phragmites australis</i>	Common reed	Invasive tendencies
<i>Picea omorika</i> and dwarf cultivars	Serbian spruce	Prefers deep, rich, moist, well-drained soils; more heat-tolerant than most spruces, but subject to borers, aphids and budworms
<i>Pittosporum tobira</i>	Japanese pittosporum	Too cold here (zone 8b best)
<i>Podocarpus macrophyllus</i> var. <i>maki</i>	Shrubby podocarpus	Marginally hardy here
<i>Polygonum cespitosum</i> ; <i>P. cuspidatum</i> ; <i>P. perfoliatum</i> ; <i>P. sachalinense</i>	Bunchy knotweed or oriental ladysthumb; Japanese knotweed; Mile-a-minute; giant knotweed	Invasive tendencies
<i>Potamogeton crispus</i>	Curly pondweed	Invasive tendencies
<i>Prunus glandulosa</i>	Flowering almond	<i>Prunus</i> species not recommended due to diseases; weak, straggly
<i>Pseudosasa japonica</i>	Arrow bamboo	Invasive tendencies
<i>Pyracantha coccinea</i>	Scarlet firethorne	Many diseases; some cultivars more resistant than species are included in recommended list

Table 4, Plants Not Recommended

Scientific Name	Common Name	Reasons for Concern
<i>Ranunculus ficaria</i>	Lesser celandine or fig buttercup	Invasive tendencies
<i>Raphanus raphanistrum</i>	Wild radish or jointed charlock	Invasive tendencies
<i>Rhamnus alnus</i> ; <i>R. cathartica</i> ; <i>R. frangula</i>	Glossy buckthorn; common buckthorn	Invasive tendencies
<i>Rhus typhina</i>	Staghorn sumac	Suckering to form colonies; should not be used widely
<i>Rorippa nasturtium-aquaticum</i>	Watercress	Invasive tendencies
<i>Rubus phoenicolasius</i>	Wineberry or wine raspberry	Invasive tendencies
<i>Rumex acetosella</i>	Red sorrel or common sheep sorrel	Invasive tendencies
<i>Ruscus aculeatus</i>	Butcher's broom	Not hardy in Durham
<i>Sabal minor</i>	Dwarf palmetto	Not hardy in Durham
<i>Sarcococca confusa</i>	Sarcococca	Not hardy in Durham
<i>Senna obtusifolia</i>	Coffeeweed or sicklepod	Invasive tendencies
<i>Setaria faberi</i> ; <i>S. pumila</i> ; <i>S. viridis</i>	Japanese bristlegrass or giant foxtail; yellow bristlegrass or smooth millet; green bristlegrass or green millet	Invasive tendencies
<i>Sorghum halepense</i>	Johnsongrass	Invasive tendencies
<i>Spiraea japonica</i>	Japanese meadowsweet	Invasive tendencies
<i>Spiraea prunifolia</i>	Bridalwreath spirea	Straggly, open, coarse, with foliage on upper 50% of the plant
<i>Stellaria media</i>	Common chickweed	Invasive tendencies
<i>Syringa oblata</i> var. <i>dilatata</i> , <i>S. vulgaris</i>	Korean lilac, common lilac	Too hot here for them
<i>Syringa pekinensis</i>	Pekin lilac	Many diseases
<i>Tamarix ramosissima</i>	Saltcedar	Invasive tendencies
<i>Torilis arvensis</i>	Hedge-parsley	Invasive tendencies
<i>Trapa natans</i>	Water chestnut	Invasive tendencies
<i>Tribulus terrestris</i>	Puncturevine	Invasive tendencies
<i>Tussilago farfara</i>	Coltsfoot	Invasive tendencies
<i>Verbascum thapsus</i>	Common mullein	Invasive tendencies
<i>Veronica hederifolia</i>	Speedwell, ivyleaf	Invasive tendencies
<i>Viburnum dilitatum</i>	Arrowwood, linden	Invasive tendencies
Notes: Invasive plants from "Invasive exotic plants to avoid in the southeastern United States", compiled for the North Carolina Botanical Garden by Allison Schwartz and Johnny Randall, Spring, 1999		

Table 5, Plants Prohibited for Any Use	
Scientific Name	Common Name
<i>Ailanthus altissima</i>	Tree of Heaven
<i>Albizia julibrissin</i>	Mimosa
<i>Allaria petiole</i>	Garlic mustard
<i>Arundo donax</i>	Giant reed
<i>Ampelopsis brevipedunculata</i>	Porcelain-berry, Amur peppervine
<i>Celastrus orbiculatus</i>	Oriental bittersweet
<i>Dioscorea bulbifera</i> , <i>D. oppositifolia</i> (formerly <i>D. batatas</i>), <i>D. alata</i>	Climbing yam, air potatoes, Chinese yam, water yam
<i>Elaeagnus angustifolia</i> , <i>E. pungens</i> and <i>E. umbellata</i>	Russian, autumn and thorny olive
<i>Euonymus alata</i>	Burning bush, winged euonymus, wahoo
<i>Euonymus fortunei</i>	Winter creeper, climbing euonymus, gaiter
<i>Festuca arundinacea</i> , <i>F. elatior</i> , <i>Lolium arundinaceum</i>	Tall fescue, meadow fescue, Kentucky 31 fescue
<i>Lespedeza bicolor</i> , <i>L. cuneata</i> (<i>Sericea lespedeza</i>)	Shrubby lespedeza, bicolor lespedeza, shrub bushclover, bicolor, Chinese lespedeza
<i>Ligustrum japonicum</i> , <i>L. lucidum</i> , <i>L. sinense</i> , (<i>L. villosum</i>), <i>L. vulgare</i>	Common, Japanese, Glossy, European and Chinese privet
<i>Lonicera maackii</i> , <i>L. morrowii</i> , <i>L. tatarica</i> , <i>L. fragrantissima</i> , <i>L. x bella</i> (hybrid <i>Morrows</i> and <i>tatarian</i>)	Bush honeysuckles (Amur, Morrow's, Tatarian, Sweet-breath-of-spring, Bell's)
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Lygodium japonicum</i>	Japanese climbing fern
<i>Melia azedarach</i>	Chinaberry
<i>Microstegium vimineum</i>	Japanese stilt grass --wind/water dispersed
<i>Miscanthus sinensis</i>	Chinese silvergrass
<i>Nandina domestica</i> and cultivars with berries: 'Harbour Dwarf', 'Harbor Belle', 'Monum', 'Wood's Dwarf'	Sacred bamboo, nandina
<i>Paulownia tomentosa</i>	Princess tree
<i>Phyllostachys aurea</i> , <i>P. spp.</i> And <i>Bambusa spp.</i>	Golden bamboo and other invasive bamboos
<i>Pueraria montana</i> var. <i>lobata</i> , <i>P. lobata</i>	Kudzu
<i>Rosa multiflora</i> , <i>R. bracteata</i> , <i>R. laevigata</i>	Multiflora, Macartney and Cherokee roses
<i>Sericea lespedeza</i> (see <i>Lespedeza bicolor</i> and <i>L. cuneata</i>)	
<i>Solanum viarum</i>	Tropical soda apple
<i>Triadica sebifera</i> (<i>Sapium sebiferum</i>)	Tallowtree, Popcorn tree
<i>Vinca minor</i> , <i>V. major</i>	Periwinkles
<i>Wisteria floribunda</i> , <i>W. sinensis</i>	Japanese and Chinese wisteria
Notes: From "Invasive exotic plants to avoid in the southeastern United States", compiled for the North	

Table 5, Plants Prohibited for Any Use

Scientific Name	Common Name
Carolina Botanical Garden by Allison Schwartz and Johnny Randall, Spring, 1999; and James H. Miller, <u>Nonnative Invasive Plants of Southern Forests</u> , United States Department of Agriculture, Forest Service, Southern Research Station, General Technical Report SRS-62, Revised December, 2004. Last updated August 5, 2005.	